

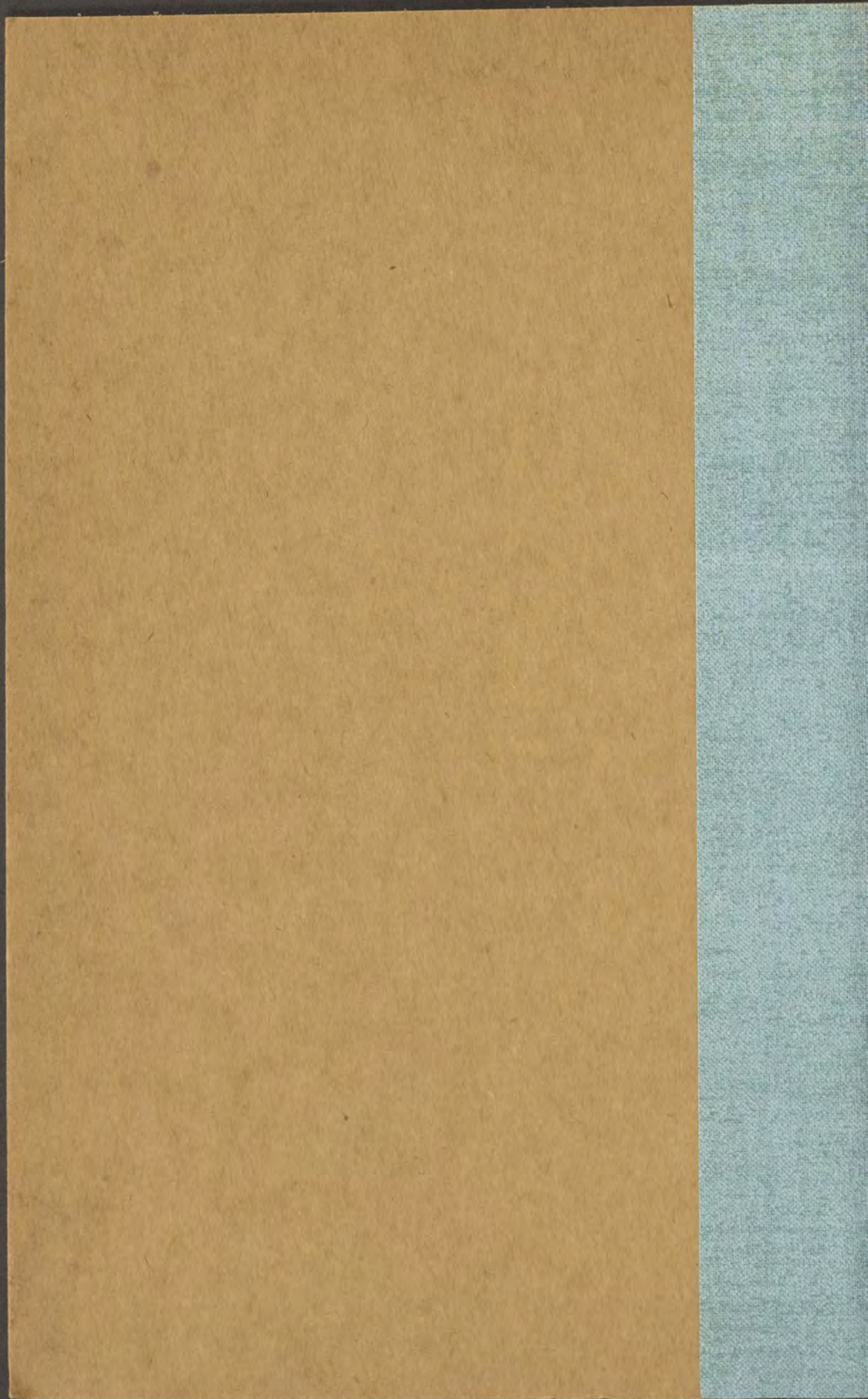
METEORITES

Analyses of Stone

FARRINGTON

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COMPILED AND CLASSIFIED  
BY

OLIVER CUMMINGS FARRINGTON

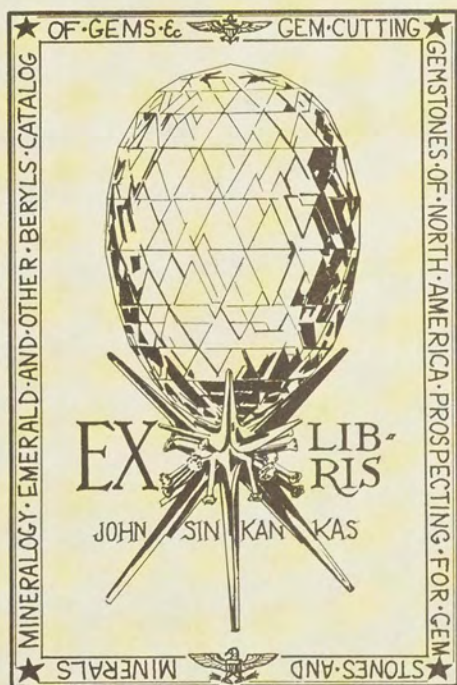
Curator, Department of Geology



CHICAGO, U. S. A.

June 1, 1911.





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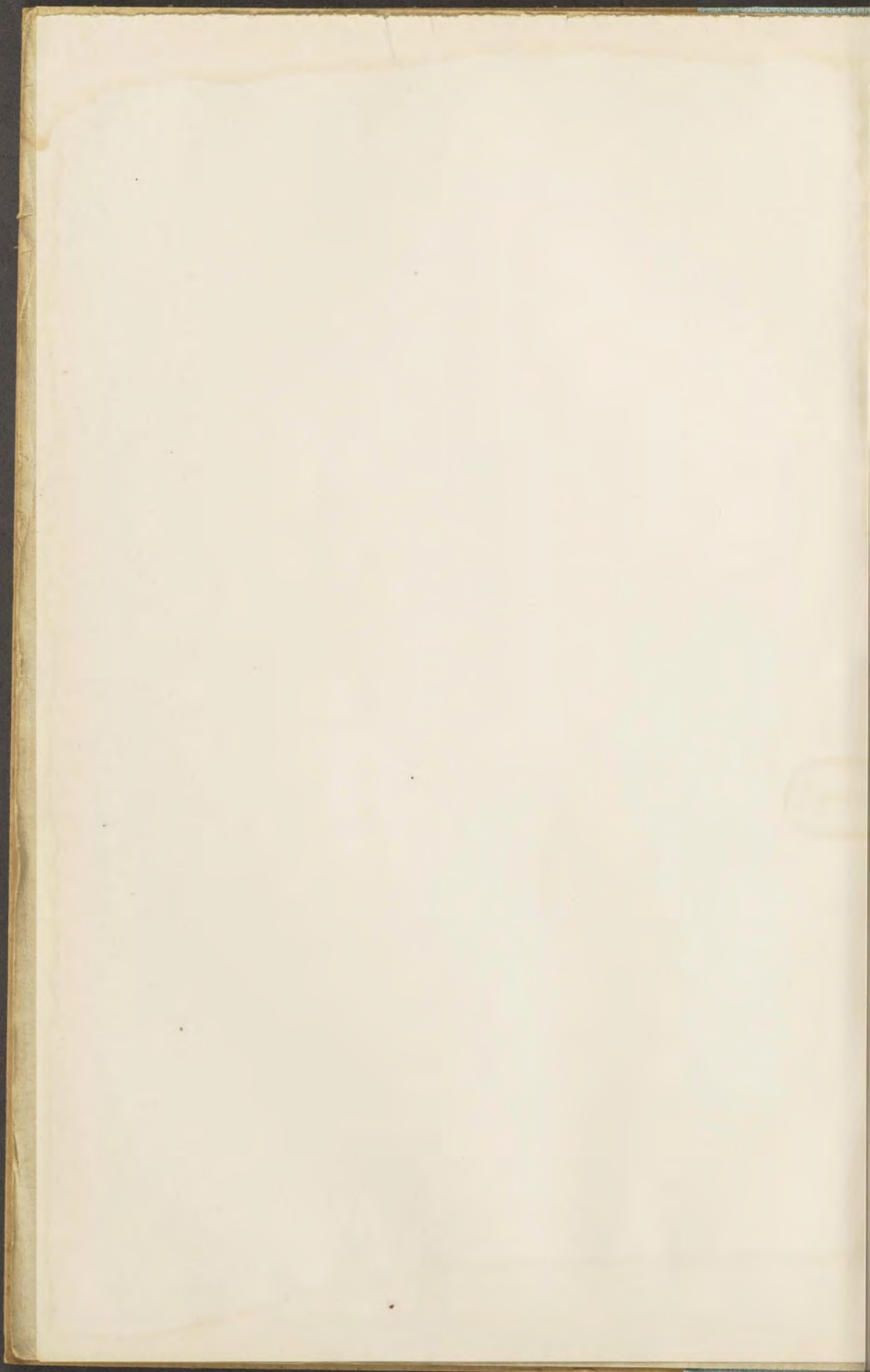
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## ANALYSES OF STONE METEORITES COMPILED AND CLASSIFIED.

BY OLIVER CUMMINGS FARRINGTON.

The object of this publication is twofold: (1) To give a compilation of analyses of stone meteorites of the same nature as that already made by the author for iron meteorites.\* (2) To use these analyses as a basis for the establishment of a quantitative classification. The plan on which the analyses have been collected for the first purpose has already been described in the introduction to the paper on Analyses of Iron Meteorites. The need of such a collection is due to the fact that as with the iron meteorites, the last extensive compilation of analyses of stone meteorites which was published was that of Wadsworth in 1884.† Since Wadsworth's compilation a number of excellent analyses have been made both of meteorites which have fallen since that time and of earlier ones, and the convenience of having these analyses grouped together for purposes of reference is obvious. The chief difference between the collection by the present writer of the analyses of the stone meteorites and that of the iron meteorites is that a more rigid selection of the analyses of the stone meteorites has been made. Only those analyses which gave satisfactory evidence of being thorough and complete have been admitted to the list. On the other hand tolerance has been exercised in the admission of analyses which might on the whole be complete although obviously containing minor errors. The greatest difficulty which has been encountered in including analyses in the collection has been that of obtaining mass analyses. It has been a common tendency of analysts of stone meteorites to give only analyses of separate portions. In order to combine the analyses of the separate portions into a mass analysis a reduction of all results to 100 is, of course, necessary. The results thus obtained probably often fail to accurately represent all the constituents of the meteorite, but on the

\* Analyses of Iron Meteorites Compiled and Classified, Field Col. Mus. Pub. 1907, Geol. Ser., Vol. 3, pp. 59-110.

† Rocks of the Cordilleras; Mem. Mus. Comp. Zool. Cambridge, Mass., 1884, Vol. II, pt. 1, pp. XVI-XXXIII.

whole no serious error need be involved. To confine reported analyses to those which were only stated in the mass form would reduce the number materially and fail to represent our true knowledge of the chemical composition of meteorites.

The second purpose for which the grouping of the analyses has been made was, as has been stated, to propose a quantitative classification. The principles of this classification are the same as those for terrestrial rocks proposed by Cross, Iddings, Pirsson, and Washington.\* It was suggested by Washington in his publication on the Chemical Analyses of Igneous Rocks and their Classification† that such a classification of meteorites be made, and the writer held a brief conference with Dr. Washington on the subject. The need of such a classification of meteorites is, perhaps, even more acute than was the case with terrestrial rocks. Of the various classifications of meteorites which have been proposed none can be considered quantitative. The classification chiefly used for stone meteorites at the present time is that which has been gradually evolved through the labors of Rose, Tschermak, Cohen, and Brezina. It is presented in its most complete form by Brezina in the Catalogue of the Ward-Coonley Collection of Meteorites.‡ As is well known, the groups of this classification are based primarily upon structure but also upon mineralogical characters. The stones are first subdivided into achondrites, chondrites, and siderolites. The achondrites are divided into a number of groups distinguished by mineralogical composition. These include the eukrites, chladnites, howardites, etc. Among the chondrites the subdivisions are based chiefly on color, the groups being designated as white, gray, black, intermediate, carbonaceous, etc., with additional divisions according to structure giving spherulitic and crystalline. Other subdivisions are based upon the presence or absence of veins and breccia-like structure. Of these divisions, that according to color cannot be regarded as resting upon any important or fundamental character, although it finds some slight justification in the fact that the lighter-colored meteorites are likely to contain more enstatite than the darker ones. Another weak feature of the classification in the view of the present writer is its failure to take account, in any definite way, of the metallic content of meteorites. The metal of meteorites is an important feature which should serve as a distinguishing mark.

So far as the iron meteorites are concerned the present system of

\* Quantitative Classification of Igneous Rocks, Chicago, 1903.

† U. S. Geological Survey, 1903, Prof. Pap. No. 14, pp. 9 and 61.

‡ Henry A. Ward, Chicago, 1904, pp. 97-101.



Brezina is quantitative, as the present writer has shown.\* The metallic content of the stone meteorites, however, finds little recognition in the Brezina system.

It will be obvious that some modification of the Quantitative Classification of terrestrial rocks is necessary in order to fit it for use with meteorites. Among these one is due to the impossibility of using regional names for the nomenclature of orders, sections, etc., of meteorites. For this reason in designation of the subdivisions the writer has used only descriptive adjectives. A group name is given only to the last group, the subrang. This name is that of a meteorite as nearly representative in composition as possible, preference being given, where there is a choice of names, to the better known meteorites. Another modification of classification necessary has been on account of the abundance of metal in meteorites. This required the formation of several subclasses in the classes in which among terrestrial rocks but a single subclass exists. Two subclasses are thus required in Class IV and four in Class V. As no nomenclature was proposed by the authors of the Quantitative Classification which would be applicable to more than one subclass, it has been necessary for the writer to provide names for the additional subclasses. This has been done by coining adjective terms indicating the relative quantities of silicates and metal. The adjectives for the five subdivisions are: persilicic, dosilicic, silico-metallic, dometallic, and permetallic. As will be noted by consulting the tables, most meteorites fall outside of the groups of terrestrial rocks. The following groups are similar in meteorites and terrestrial rocks: Kedabdekase of terrestrial rocks corresponds to Juvinose of meteorites; Wehrlose to Udenose; Argeinose to Stawropolose; Maricose to Bishopvillose; and Websterose to Bustose. Some minerals not found in terrestrial rocks occur in meteorites. To these the writer has given the following abbreviations: troilite, *tr*; oldhamite, *oh*; nickel-iron, *nf*. As it is occasionally necessary to assume the presence of the molecule  $(Mg, Fe)O$  in meteorites, the name *femite* and abbreviation *mo* are proposed for it. The standard minerals assumed to be present in meteorites and their abbreviations are then as follows:

## GROUP I: SALIC MINERALS

Quartz, $Si\ O_2$ .....		Q
Zircon, $Zr\ O_2 \cdot Si\ O_2$ .....		Z
Orthoclase, $K_2\ O \cdot Al_2\ O_3 \cdot 6\ Si\ O_2$ .....	or	F
Albite, $Na_2\ O \cdot Al_2\ O_3 \cdot 6\ Si\ O_2$ .....	ab	
Anorthite, $Ca\ O \cdot Al_2\ O_3 \cdot 2\ Si\ O_2$ .....	an	

\* Field Col. Mus. Pub. 1907, Geol. Ser., Vol. 3, p. 108.

Leucite, $K_2 O \cdot Al_2 O_3 \cdot 4 Si O_2$ . . . . .	lc	} L
Nephelite, $Na_2 O \cdot Al_2 O_3 \cdot 2 Si O_2$ . . . . .	nc	
Kaliophilite, $K_2 O \cdot Al_3 O_3 \cdot 2 Si O_2$ . . . . .	kp	

## GROUP II: FEMIC MINERALS

Acmite, $Na_2 O \cdot Fe_2 O_3 \cdot 4 Si O_2$ . . . . .	ac	} P
Sodium metasilicate, $Na_2 O \cdot Si O_2$ . . . . .	ns	
Potassium metasilicate, $K_2 O \cdot Si O_2$ . . . . .	ks	
Diopside, $Ca O \cdot (Mg, Fe) O \cdot 2 Si O_2$ . . . . .	di	
Wollastonite, $Ca O \cdot Si O_2$ . . . . .	wo	
Hypersthene, $(Mg, Fe) O \cdot Si O_2$ . . . . .	hy	} O
Olivine, $2 (Mg, Fe) O \cdot Si O_2$ . . . . .	ol	
Akermanite, $4 Ca O \cdot 3 Si O_2$ . . . . .	am	
Magnetite, $Fe O \cdot Fe_2 O_3$ . . . . .	mt	} M
Femite, $Mg, Fe O$ . . . . .	mo	
Chromite, $Fe O \cdot Cr_2 O_3$ . . . . .	om	
Hematite, $Fe_2 O_3$ . . . . .	hm	
Ilmenite, $Fe O \cdot Ti O_2$ . . . . .	il	
Apatite, $3 (3 Ca O \cdot P_2 O_5) \cdot Ca F_2$ . . . . .	ap	} A
Troilite, $Fe S$ . . . . .	tr	
Oldhamite, $Ca S$ . . . . .	oh	
Schreibersite, $(Fe, Ni)_3 P$ . . . . .	sc	
Nickel-iron, $Fe_n, Ni_m$ . . . . .	nf	

The methods of calculating the analyses of meteorites in order to determine their place in this classification are the same as those adopted for terrestrial rocks by the authors of the Quantitative Classification. These are given in detail in their publication. As it may be convenient, however, to have the quantitative classification of meteorites so far as possible complete in itself, so much of the methods of calculation as is deemed necessary is here repeated from the work of the authors of the Quantitative Classification.\*

1. Determine the molecular proportions of the chemical components of a rock as expressed by the complete analysis, by dividing the percentage weights of each component by its molecular weight.

2. Before undertaking the distribution of the chemical components as mineral molecules, small amounts of  $Mn O$  and  $Ni O$  are to be united with  $Fe O$ , and of  $Ba O$  and  $Sr O$  with  $Ca O$ ; of  $Cr_2 O_3$  with  $Fe_2 O_3$ , unless these unusual components occur in sufficient amounts to make their calculation as special mineral molecules desirable.

3. Establish the fixed molecules by allotting:

a) to  $Cr_2 O_3$ , if present in notable amount,  $Fe O$  to satisfy the ratio  $Cr_2 O_3 : Fe O :: 1 : 1$  for chromite:

b) to  $Ti O_2$  enough  $Fe O$  to satisfy the ratio  $Ti O_2 : Fe O :: 1 : 1$  for ilmenite. If there is excess of  $Ti O_2$ , allot to it equal  $Ca O$  for titanite or perovskite according to available silica, to be determined later. If there is an excess of  $Ti O_2$  it is to be calculated as rutile.

\* *Loc. cit.* pp. 188-195.



c) to  $P_2O_5$  allot enough Ca O to satisfy the ratio  $P_2O_5 : Ca O :: 1 : 3.33$  for apatite. Allot F or Cl to satisfy  $Ca O = 0.33 P_2O_5$ ;

d) to F not used in apatite allot Ca O to form fluorite,  $Ca O : F :: 1 : 2$ ;

e) to Cl allot  $Na_2O$  in the ratio  $Cl_2 : Na_2(O) :: 1 : 1$  for sodalite;

f) to  $SO_3$  allot  $Na_2O$  in proportion  $SO_3 : Na_2O :: 1 : 1$  for noselite;

g) to S allot Fe O in proportion  $S : Fe(O) :: 2 : 1$  for pyrite;

h) to  $CO_2$  in undecomposed rocks allot Ca O in the proportion  $1 : 1$  for calcite.  $CO_2$  may occur in primary calcite and cancrinite. If these minerals are secondary, the  $CO_2$  is to be neglected, since it is understood that analyses of decomposed rocks are not available for purposes of classification.

Having adjusted the minor, inflexible, molecules, there remain the more important but variable silicate molecules, which form the great part of the mineral composition, or *norm*, of most rocks.

4. To  $Al_2O_3$  are allotted all the  $K_2O$  and  $Na_2O$  not already disposed of, in the proportion of  $Al_2O_3 : K_2O + Na_2O :: 1 : 1$  for alkali feldspathic and feldspathoid (lenad) molecules.

5. With excess of  $Al_2O_3$ , ( $Al_2O_3 > K_2O + Na_2O$ );

a) to extra  $Al_2O_3$  allot Ca O in proportion of  $Al_2O_3 : Ca O :: 1 : 1$  for anorthite molecules.

b) If there is further excess of  $Al_2O_3$  it is to be considered as corundum,  $Al_2O_3$ .

6. With insufficient  $Al_2O_3$ , ( $Al_2O_3 < K_2O + Na_2O$ );

a) Extra  $Na_2O$  is allotted to  $Fe_2O_3$  in proportion  $Fe_2O_3 : Na_2O :: 1 : 1$  for acmite molecules.

b) If there is still extra  $Na_2O$  it is set aside for a metasilicate molecule ( $Na_2SiO_3$ ).

c) When there is an excess of  $K_2O$  over  $Al_2O_3$  it is treated in the same manner. It is an extremely rare occurrence.

7. In working with reliable analyses in which  $Fe_2O_3$  and Fe O have been correctly determined:

a) To  $Fe_2O_3$  is allotted excess of  $Na_2O$  under conditions 6, a).

b) To remaining  $Fe_2O_3$  is allotted available Fe O in equal proportions for magnetite.

c) If there is any excess of  $Fe_2O_3$  it is calculated as hematite.

Analyses in which all the iron has been determined in one form of oxidation, when it occurs in two, are of little value when considerable iron is present. When the amount of iron is very small the analyses may still be used as a means of classifying the rock. For this purpose all the iron, if given as ferric oxide, is to be calculated as Fe O, except that necessary to be allotted to  $Na_2O$  for acmite, and then used as below.

8. a) Extra Ca O after the foregoing assignments is allotted to (Mg, Fe) O in proportion  $Ca O : (Mg, Fe) O :: 1 : 1$  for diopside molecules.

In all molecules where (Mg, Fe) O is present, Mg O and Fe O are to be used in the same proportions in which they are found after Fe O has been allotted to the molecules previously mentioned. That is, they are to be introduced into diopside, hypersthene, and olivine with the same ratio between them.

b) If there is still an excess of Ca O it is to be set aside for calcium metasilicate ( $CaSiO_3$ ) or subsilicate ( $4CaO \cdot 3SiO_2$ ), equivalent to wollastonite or akermanite. Such extra Ca O will in most cases actually enter garnet, an alferic mineral.

9. With insufficient Ca O, ( $Ca O < (Mg, Fe) O$ );

a) Extra (Mg, Fe) O is to be set aside for metasilicate or orthosilicate, hypersthene or olivine, according to the amount of  $SiO_2$  present.

The allotment of  $\text{Si O}_2$  to form silicates begins with the bases which occur with silica in but one proportion, and is carried on as follows:

10. To  $\text{Zr O}_2$  allot  $\text{Si O}_2$  in proportion of 1 : 1 for zircon.
  11. To  $\text{Ca O}$  and  $\text{Al}_2 \text{O}_3$  in anorthite is allotted equal  $\text{Si O}_2$  to form  $\text{Ca O} \cdot \text{Al}_2 \text{O}_3 \cdot 2 \text{Si O}_2$ .
  12. To  $\text{Ca O}$  and  $(\text{Mg, Fe}) \text{O}$  in diopside is allotted equal  $\text{Si O}_2$  to form  $\text{Ca O} \cdot (\text{Mg, Fe}) \text{O} \cdot 2 \text{Si O}_2$ .
  13. To  $\text{Na}_2 \text{O}$  and  $\text{Fe}_2 \text{O}_3$  in acmite is allotted  $\text{Si O}_2$  to form  $\text{Na}_2 \text{O} \cdot \text{Fe}_2 \text{O}_3 \cdot 4 \text{Si O}_2$ .
  14. To  $\text{Na}_2 \text{O}$  (or  $\text{K}_2 \text{O}$ ) set aside for metasilicate molecules allot  $\text{Si O}_2$  to form  $\text{Na}_2 \text{O} \cdot \text{Si O}_2$  or  $\text{K}_2 \text{O} \cdot \text{Si O}_2$ .
  15. To  $\text{Na}_2 \text{O}$  and  $\text{Al}_2 \text{O}_3$  in sufficient amount to form with  $\text{Na Cl}$  sodalite, or with  $\text{Na}_2 \text{SO}_4$  noselite, is allotted  $\text{Si O}_2$  to satisfy the formulas : 3  $(\text{Na}_2 \text{O} \cdot \text{Al}_2 \text{O}_3 \cdot 2 \text{Si O}_2) \cdot 2 \text{Na Cl}$ , sodalite, 2  $(\text{Na}_2 \text{O} \cdot \text{Al}_2 \text{O}_3 \cdot 2 \text{Si O}_2) \cdot \text{Na}_2 \text{SO}_4$  noselite.
  16. To  $\text{Ca O}$  set aside for wollastonite or akermanite is allotted tentatively  $\text{Si O}_2$  to form wollastonite  $(\text{Ca O} \cdot \text{Si O}_2)$ .
  17. To extra  $(\text{Mg, Fe}) \text{O}$  is allotted  $\text{Si O}_2$  to form orthosilicate, olivine  $(2 (\text{Mg, Fe}) \text{O} \cdot \text{Si O}_2)$ .
  18. To  $\text{Al}_2 \text{O}_3$  and  $\text{K}_2 \text{O} + \text{Na}_2 \text{O}$  is allotted  $\text{Si O}_2$  to make the polysilicates, orthoclase and albite,  $\text{K}_2 \text{O} \cdot \text{Al}_2 \text{O}_3 \cdot 6 \text{Si O}_2$  and  $\text{Na}_2 \text{O} \cdot \text{Al}_2 \text{O}_3 \cdot 6 \text{Si O}_2$ .
- a) If there is an excess of  $\text{Si O}_2$  it is added to the orthosilicate of  $(\text{Mg, Fe}) \text{O}$  to raise it to the metasilicate  $(\text{Mg, Fe}) \text{O} \cdot \text{Si O}_2$ . If  $\text{Si O}_2$  is insufficient to convert all the olivine into hypersthene it is distributed according to the following equations:

$$x + y = \text{molecules of } (\text{Mg, Fe}) \text{O}.$$

$$x + \frac{y}{2} = \text{available } \text{Si O}_2.$$

where  $x$  = hypersthene,  $\frac{y}{2}$  = olivine molecules.

b) Further excess of  $\text{Si O}_2$  is to be allotted to  $\text{Ti O}_2$  and  $\text{Ca O}$  to form titanite. These constituents remain as perovskite when there is no excess of  $\text{Si O}_2$ .

c) Further excess of  $\text{Si O}_2$  is reckoned as quartz.

19. If there is insufficient  $\text{Si O}_2$  to form polysilicate feldspar out of all the  $\text{K}_2 \text{O}$  and  $\text{Na}_2 \text{O}$  with  $\text{Al}_2 \text{O}_3$ :

a) To  $\text{K}_2 \text{O} \cdot \text{Al}_2 \text{O}_3$  is allotted tentatively enough  $\text{Si O}_2$  to form polysilicate, orthoclase  $(\text{K}_2 \text{O} \cdot \text{Al}_2 \text{O}_3 \cdot 6 \text{Si O}_2)$  and the remaining  $\text{Si O}_2$  is distributed between albite and nephelite molecules by means of the equations:

$$x + y = \text{molecules of } \text{Na}_2 \text{O}.$$

$$6x + 2y = \text{available } \text{Si O}_2.$$

where  $x$  = albite, and  $y$  = nephelite molecules.

b) If the available  $\text{Si O}_2$  in case 15, a) is insufficient to form nephelite with the  $\text{Na}_2 \text{O}$ , then enough  $\text{Si O}_2$  is first allotted to the  $\text{Na}_2 \text{O}$  to form nephelite and the remaining  $\text{Si O}_2$  is distributed between orthoclase and leucite molecules by means of the equations:

$$x + y = \text{molecules of } \text{K}_2 \text{O}.$$

$$6x + 4y = \text{available } \text{Si O}_2.$$

where  $x$  = orthoclase, and  $y$  = leucite molecules.

20. If there is insufficient  $\text{Si O}_2$  to form leucite and nephelite with olivine it is necessary to reduce a sufficient number of molecules to form the subsilicate akermanite,  $4\text{Ca O} \cdot 3 \text{Si O}_2$ .



a) In case there is no wollastonite this is done after distributing  $\text{Si O}_2$  tentatively to form leucite, nephelite, and olivine, and noting the deficit of  $\text{Si O}_2$  by means of the equation:

$$y = \frac{1}{3} \text{ of the deficit of Si O}_2.$$

$$y = \text{molecules of akermanite. (4 Ca O.3 Si O}_2\text{).}$$

Ca O is to be taken from diopside, and the Mg O and Fe O so liberated are to be calculated as olivine.

b) In case an excess of Ca O has been set aside for wollastonite this is first converted to akermanite by means of the equations:

$$y = \text{the deficit of Si O}_2.$$

$$y = \text{molecules of akermanite (4 Ca O.3 Si O}_2\text{).}$$

c) If there are not sufficient molecules of wollastonite to satisfy the deficit of silica, recalculate the molecules of diopside and wollastonite so as to make olivine, diopside, and akermanite by means of the formulæ:

$$2x + 3y + \frac{z}{2} = \text{available Si O}_2.$$

$$x + 4y = \text{molecules of Ca O.}$$

$$x + z = \text{molecules of Mg O + Fe O.}$$

where  $x$  = molecules of new diopside,  $y$  = molecules of akermanite (4 Ca O.3 Si O<sub>2</sub>), and  $z$  = molecules of olivine.

21. If there is still not enough  $\text{Si O}_2$ , all the Ca O of the diopside and wollastonite must be calculated as akermanite, the (Mg, Fe) O being reckoned as olivine and the  $\text{K}_2\text{O}$  distributed between leucite and kaliophilite by the equations:

$$x + y = \text{molecules of K}_2\text{O.}$$

$$4x + 2y = \text{available Si O}_2.$$

where  $x$  is  $\text{K}_2\text{O}$  in leucite and  $y$  =  $\text{K}_2\text{O}$  in kaliophilite.

22. In case there is insufficient  $\text{Si O}_2$  and an excess of  $\text{Al}_2\text{O}_3$  and (Mg, Fe) O, which might form aluminum spinel, an alferic mineral, the excess of  $\text{Al}_2\text{O}_3$  is to be calculated as corundum, and the uncombined (Mg, Fe) O is to be estimated as femic minerals, being placed with the nonsilicate, mic group, magnetite, ilmenite, etc.

## GLOSSARY

### A

Alkalicalcic. Having salic alkalis and salic lime present in equal or nearly equal amounts.  $\frac{K_2 O' + Na_2 O'}{Ca O'} < \frac{5}{3} > \frac{3}{5}$ .

### C

Calcimirc. Equally calcic and miric, or nearly so.  $\frac{Mg O + Fe O}{Ca O} < \frac{5}{3} > \frac{3}{5}$ .

Class. Division of igneous rocks based on the relative proportions of salic and femic standard minerals.

### D

Do- (or dom) Prefix indicating that one factor dominates over another within the ratios  $\frac{7}{1}$  and  $\frac{5}{3}$ .

Docalcic. Dominantly calcic. Of salic minerals when  $Ca O'$  dominates over  $K_2 O' + Na_2 O'$ .  $\frac{K_2 O' + Na_2 O'}{Ca O'} < \frac{3}{5} > \frac{1}{7}$ . Of femic minerals when  $Ca O''$  dominates over  $Mg O + Fe O$ .  $\frac{Mg O + Fe O}{Ca O''} < \frac{3}{5} > \frac{1}{7}$ .

Dofelic. Dominantly felic, having normative feldspar dominant over normative quartz or lenads.  $\frac{Q \text{ or } L}{F} < \frac{3}{5} > \frac{1}{7}$ .

Dofemane. Class IV of igneous rocks, having femic minerals dominant over salic.

$$\frac{Sal}{Fem} < \frac{3}{5} > \frac{1}{7}.$$

Dofemic. Dominantly femic, having femic minerals dominant over salic.

$$\frac{Sal}{Fem} < \frac{3}{5} > \frac{1}{7}.$$

Doferrous. Dominantly ferrous, having  $Fe O$  dominant over  $Mg O$ .

$$\frac{Mg O}{Fe O} < \frac{3}{5} > \frac{1}{7}.$$

Domagnesian. Dominantly magnesian, having  $Mg O$  dominant over  $Fe O$ .

$$\frac{Mg O}{Fe O} < \frac{7}{1} > \frac{5}{3}.$$

Domalkalic. Dominantly alkalic; of salic minerals when  $K_2 O' + Na_2 O'$  dominates over  $Ca O'$ .  $\frac{K_2 O' + Na_2 O'}{Ca O'} < \frac{7}{1} > \frac{5}{3}$ . Of femic minerals when  $K_2 O'' + Na_2 O''$  dominates over  $Mg O + Fe O + Ca O''$ .

$$\frac{Mg O + Fe O + Ca O''}{K_2 O'' + Na_2 O''} < \frac{3}{5} > \frac{1}{7}.$$



Domiric. Dominantly miric, having  $\text{Mg O} + \text{Fe O}$  dominant over  $\text{Ca O}''$ .

$$\frac{\text{Mg O} + \text{Fe O}}{\text{Ca O}''} < \frac{7}{1} > \frac{5}{3}.$$

Domirlic. Dominantly mirlic, having  $\text{Mg O} + \text{Fe O} + \text{Ca O}''$  dominant over

$$\text{K}_2 \text{O}'' + \text{Na}_2 \text{O}''. \quad \frac{\text{Mg O} + \text{Fe O} + \text{Ca O}''}{\text{K}_2 \text{O} + \text{Na}_2 \text{O}''} < \frac{7}{1} > \frac{5}{3}.$$

Domitic. Dominantly mitic, having mitic minerals (magnetite, hematite, ilmenite, titanite, etc.) dominant over polie minerals (pyroxene, olivine, akermanite).

$$\frac{\text{P O}}{\text{M}} < \frac{3}{5} > \frac{1}{7}.$$

Domolic. Dominantly olic, having normative olivine and akermanite dominant

$$\text{over normative pyroxenes.} \quad \frac{\text{P}}{\text{O}} < \frac{3}{5} > \frac{1}{7}.$$

Dopolic. Dominantly polie, having polie minerals (pyroxene, olivine) dominant

$$\text{over mitic minerals (magnetite, ilmenite, etc.).} \quad \frac{\text{P O}}{\text{M}} < \frac{7}{1} > \frac{5}{3}.$$

Dopotassic. Dominantly potassic, having  $\text{K}_2 \text{O}$  dominant over  $\text{Na}_2 \text{O}$ .

$$\frac{\text{K}_2 \text{O}}{\text{Na}_2 \text{O}} < \frac{7}{1} > \frac{5}{3}.$$

Dopyric. Dominantly pyric, having normative pyroxene dominant over normative

$$\text{olivine and akermanite.} \quad \frac{\text{P}}{\text{O}} < \frac{7}{1} > \frac{5}{3}.$$

Doquaric. Dominantly quaric, having normative quartz dominant over normative

$$\text{feldspar.} \quad \frac{\text{Q}}{\text{F}} < \frac{7}{1} > \frac{5}{3}.$$

Dosalic. Dominantly salic, having the salic minerals dominant over the femic.

$$\frac{\text{Sal}}{\text{Fem}} < \frac{7}{1} > \frac{5}{3}.$$

Dosodic. Dominantly sodic, having  $\text{Na}_2 \text{O}$  dominant over  $\text{K}_2 \text{O}$ .

$$\frac{\text{K}_2 \text{O}}{\text{Na}_2 \text{O}} < \frac{3}{5} > \frac{1}{7}.$$

## E

Extreme. Said of a factor that is present alone or in amount greater than 7:1 of the other factor.

## F

Felic. Having the properties of, or containing, the feldspars.

Fem. Term mnemonic of the second group of standard minerals, including non-aluminous ferromagnesian and calcic silicates, silicotitanates and non-siliceous and non-aluminous minerals.

Femic. Having the character of, or belonging to, the second (fem) group of standard minerals.

## L

Len. Syllable mnemonic of leucite and nephelite, including sodalite and noselite, the feldspathoids.

Lenad. One of the standard minerals, leucite, nephelite, sodalite or noselite.

## M

Magnesiferrous. Equally magnesian and ferrous, or nearly so.

$$\frac{\text{Mg O}}{\text{Fe O}} < \frac{5}{3} > \frac{3}{5}.$$

Mir. Syllable mnemonic of magnesia and ferrous iron.

Miric. Characterized by presence of Mg O and Fe O.

Mirl. Syllable mnemonic of magnesia, ferrous iron, and lime.

Mirlic. Characterized by presence of Mg O, Fe O, and Ca O.

Mit. Syllable mnemonic of magnetite, ilmenite, and titanite, and including all minerals of the second subgroup of femic minerals.

Mitic. Adjective referring to the above mentioned minerals.

Mode. The actual mineral composition of a rock. Opposed to norm, with which it may or may not coincide.

## O

Ol. Syllable mnemonic of olivine, embracing also akermanite.

Olic. Having the proportions of, or containing, normative olivine or akermanite.

Order. A division of Subclass based on the relative proportions of the standard mineral subgroups in the preponderant group.

## P

Per- Prefix to indicate that a factor is present alone, or in extreme amount; that is, its ratio to another factor is  $> \frac{7}{1}$ .

Peralkalic. Extremely alkalic. Of salic minerals when  $\text{K}_2 \text{O}' + \text{Na}_2 \text{O}'$  is more than seven times  $\text{Ca O}'$ .  $\frac{\text{K}_2 \text{O}' + \text{Na}_2 \text{O}'}{\text{Ca O}'} > \frac{7}{1}$ . Of femic minerals when  $\text{K}_2 \text{O}'' + \text{Na}_2 \text{O}''$  is more than seven times  $\text{Mg O} + \text{Fe O} + \text{Ca O}''$ .

$$\frac{\text{Mg O} + \text{Fe O} + \text{Ca O}''}{\text{K}_2 \text{O}'' + \text{Na}_2 \text{O}''} < \frac{1}{7}.$$

Percalcic. Extremely calcic. Of salic minerals when  $\text{Ca O}'$  is more than seven times  $\text{K}_2 \text{O}' + \text{Na}_2 \text{O}'$ .  $\frac{\text{K}_2 \text{O}' + \text{Na}_2 \text{O}'}{\text{Ca O}'} < \frac{1}{7}$ . Of femic minerals when  $\text{Ca O}''$  is more than seven times  $\text{Mg O} + \text{Fe O}$ .  $\frac{\text{Mg O} + \text{Fe O}}{\text{Ca O}''} < \frac{1}{7}$ .

Perfelic. Extremely felic. When normative feldspar is more than seven times the normative quartz or leucite.  $\frac{\text{Q or L}}{\text{F}} < \frac{1}{7}$ .

Perfemane. Class V of igneous rocks, having femic minerals extremely abundant.

$$\frac{\text{Sal}}{\text{Fem}} < \frac{1}{7}.$$

Perfemic. Extremely femic. Having femic minerals more than seven times the salic.

$$\frac{\text{Sal}}{\text{Fem}} < \frac{1}{7}.$$

Perferrous. Extremely ferrous. When Fe O is more than seven times Mg O.

$$\frac{\text{Mg O}}{\text{Fe O}} < \frac{1}{7}.$$



Permagnesic. Extremely magnesian; having Mg O more than seven times Fe O.

$$\frac{\text{Mg O}}{\text{Fe O}} > \frac{7}{1}.$$

Permircic. Extremely miric; having Mg O + Fe O more than seven times Ca O''.

$$\frac{\text{Mg O} + \text{Fe O}}{\text{Ca O}''} > \frac{7}{1}.$$

Permircic. Extremely miric; having Mg O + Fe O + Ca O'' more than seven times K<sub>2</sub> O'' + Na<sub>2</sub> O''.  $\frac{\text{Mg O} + \text{Fe O} + \text{Ca O}''}{\text{K}_2 \text{ O}'' + \text{Na}_2 \text{ O}''} > \frac{7}{1}.$

Perolic. Extremely olic; having olic minerals (olivine, akermanite) more than seven times the pyric minerals (pyroxenes).  $\frac{\text{P}}{\text{O}} < \frac{1}{7}.$

Perpolic. Extremely polic, having polic minerals (pyroxenes, olivine, akermanite) more than seven times the mitic minerals (magnetite, ilmenite, titanite, hematite, etc.).  $\frac{\text{P O}}{\text{M}} > \frac{7}{1}.$

Perpotassic. Extremely potassic, having K<sub>2</sub> O' more than seven times Na<sub>2</sub> O'.

$$\frac{\text{K}_2 \text{ O}'}{\text{Na}_2 \text{ O}'} > \frac{7}{1}.$$

Perpyric. Extremely pyric, having pyric minerals (pyroxenes) more than seven times the olic minerals (olivine, akermanite).  $\frac{\text{P}}{\text{O}} > \frac{7}{1}.$

Perquarfelic. Extremely quarfellenic; having normative quartz, feldspar, and feldspathoids more than seven times corundum and zircon.  $\frac{\text{Q F L}}{\text{C Z}} > \frac{7}{1}.$

Perquaric. Extremely quaric; having normative quartz more than seven times the normative feldspar.  $\frac{\text{Q}}{\text{F}} > \frac{7}{1}.$

Pol. Syllable mnemonic of the femic silicates pyroxenes and olivine, including akermanite.

Polic. Characterized by the presence of the femic silicates.

Polmitic. Having equal or nearly equal amounts of polic and mitic minerals.

$$\frac{\text{P O}}{\text{M}} < \frac{5}{3} > \frac{3}{5}.$$

Pyr. Syllable mnemonic of pyroxenes.

Pyrolitic. Having equal, or nearly equal amounts of normative pyroxene and olivine or akermanite.  $\frac{\text{P}}{\text{O}} < \frac{5}{3} > \frac{3}{5}.$

## Q

Quar. Syllable mnemonic of quartz.

Quardofelic. Having felic minerals (feldspar) dominant over normative quartz.

$$\frac{\text{Q}}{\text{F}} < \frac{7}{1} > \frac{5}{3}.$$

Quarfelic. Having equal or nearly equal amounts of normative quartz and feldspars.

$$\frac{\text{Q}}{\text{F}} < \frac{5}{3} > \frac{3}{5}.$$

## R

Rang. (Old form of rank.) Division of Order based on the character of the chemical bases in the preponderant group of standard minerals.

## S

Sal. Syllable mnemonic of the silico-aluminous non-ferromagnesian group of standard minerals, including quartz, feldspars, leucites, corundum and zircon.

Salfemane. Class III of igneous rocks; having salic and femic minerals in equal or

nearly equal proportions.  $\frac{\text{Sal}}{\text{Fem}} < \frac{5}{3} > \frac{3}{5}$ .

Salfemic. Having salic and femic minerals in equal or nearly equal amounts.

$$\frac{\text{Sal}}{\text{Fem}} < \frac{5}{3} > \frac{3}{5}$$

Salic. Having the characters of, or belonging to, the first (sal) group of standard minerals.

Section. Subdivision of any of the other taxonomic divisions from Class to Subgrad.

Subrang. Division of Rang, based on the character of the chemical bases in the preponderant mineral subgroup used in forming Rang.

In order to still further indicate the manner in which the calculations upon which the place of each meteorite in the classification is based are made, two examples of such calculations are here given. The first illustrates the calculation of the mineral components which characterize the great majority of the stony meteorites, the analysis chosen for the calculation being one of the Allegan meteorite made by Stokes.

In the second example is shown the manner of adjusting silica among the different minerals after a preliminary calculation has indicated that too little silica is present to form the more highly siliceous ones. The analysis is one of Felix made by Fireman.



## EXAMPLE I

## ALLEGAN

Proc. Washington Acad. Sci. 1900, 2, 51

	Per Cent.	Mol.	Apat.	Ilm.	Chrom.	Orth.	Alb.	An.	Diop.	Rem' der.	Hyp.	Oliv.
Si O <sub>2</sub> .....	34.95	583	..	..	..	12	66	24	22	459	262	197
Al <sub>2</sub> O <sub>3</sub> .....	2.55	25	..	..	..	2	11	12	..	..	..	..
Cr <sub>2</sub> O <sub>3</sub> .....	.53	3	..	..	3	..	..	..	..	..	..	..
Fe O .....	8.47	118	..	1	3	..	..	..	..	..	..	..
Mn O .....	.18	3	..	..	..	..	..	..	11	656	262	394
Mg O .....	21.99	550	..	..	..	..	..	..	..	..	..	..
Ca O .....	1.73	30	7	..	..	..	..	12	11	..	..	..
Na <sub>2</sub> O .....	.66	11	..	..	..	..	11	..	..	..	..	..
K <sub>2</sub> O .....	.23	2	..	..	..	2	..	..	..	..	..	..
H <sub>2</sub> O .....	.25	..	..	..	..	..	..	..	..	..	..	..
Ti O <sub>2</sub> .....	.08	1	..	1	..	..	..	..	..	..	..	..
Fe .....	21.09	..	..	..	..	..	..	..	..	..	..	..
Ni .....	1.81	..	..	..	..	..	..	..	..	..	..	..
Co .....	.05	..	..	..	..	..	..	..	..	..	..	..
Cu .....	.01	..	..	..	..	..	..	..	..	..	..	..
Fe S .....	5.05	..	..	..	..	..	..	..	..	..	..	..
P <sub>2</sub> O <sub>5</sub> .....	.27	2	2	..	..	..	..	..	..	..	..	..
Sum .....	100.00	..	..	..	..	..	..	..	..	..	..	..

$$x + y = 656 \text{ (Mg. Fe) O}$$

$$x + \frac{y}{2} = 459 \text{ Si O}_2$$

$$x = 262$$

$$y = 394$$

Formula	Mol. Wt.		Norm
K <sub>2</sub> O.Al <sub>2</sub> O <sub>3</sub> .6 Si O <sub>2</sub> ..	2 × 556	= orthoclase	= 1.11
Na <sub>2</sub> O.Al <sub>2</sub> O <sub>3</sub> .6 Si O <sub>2</sub> ..	11 × 524	= albite	= 5.76
Ca O.Al <sub>2</sub> O <sub>3</sub> .2 Si O <sub>2</sub> ..	12 × 278	= anorthite	= 3.34
{ Ca O.Si O <sub>2</sub> .....	11 × 116	} = diopside	= 2.44
{ Mg O.Si O <sub>2</sub> .....	9 × 100		
{ Fe O.Si O <sub>2</sub> .....	2 × 132		
{ Mg O.Si O <sub>2</sub> .....	216 × 100	} = hypersthene	= 27.67
{ Fe O.Si O <sub>2</sub> .....	46 × 132		
{ 2 Mg O.Si O <sub>2</sub> .....	325 × 70		
{ 2 Fe O.Si O <sub>2</sub> .....	69 × 102	} = olivine	= 29.79
Fe O.Cr <sub>2</sub> O <sub>3</sub> .....	3 × 224		
Fe O. Ti O <sub>2</sub> .....	1 × 152		
3 Ca O.P <sub>2</sub> O <sub>5</sub> .....	2 × 310	= apatite	= .62
Fe S .....		= troilite	= 5.05
Fe <sub>n</sub> Ni <sub>m</sub> .....		= nickel-iron	= 23.06
99.66			

$$\frac{\text{Sal}}{\text{Fem}} = \frac{10.21}{89.45} < \frac{1}{7}, \quad \frac{\text{POM}}{\text{A}} = \frac{60.72}{28.73} < \frac{7}{1} > \frac{5}{3}, \quad \frac{\text{PO}}{\text{M}} = \frac{59.90}{.82} > \frac{7}{1}, \quad \frac{\text{P}}{\text{O}} = \frac{30.11}{29.79} < \frac{5}{3} > \frac{3}{5}$$

$$\frac{\text{Ca O} + \text{Mg O} + \text{Fe O}}{\text{Na}_2 \text{O}} = \frac{690}{11} > \frac{7}{1}, \quad \frac{\text{Mg O} + \text{Fe O}}{\text{Ca O}} = \frac{667}{23} > \frac{7}{1}, \quad \frac{\text{Mg O}}{\text{Fe O}} = \frac{550}{117} < \frac{7}{1} > \frac{5}{3}$$

## EXAMPLE II

## FELIX

Proc. U. S. Nat. Mus. 1901, 24, 197

	Per Cent.	Mol.	Chromite	Leuc.	Nep.	An.	Tentative		Deficit	Ak.	Final	
							Diop.	Oliv.			Diop.	Olv.
Si O <sub>2</sub> .....	33.57	560	..	4	20	40	154	437	95	57	2	437
Al <sub>2</sub> O <sub>3</sub> .....	3.24	31	..	1	10	20	..	..	..	..	..	..
Cr <sub>2</sub> O <sub>3</sub> .....	.80	5	5	..	..	..	..	..	..	..	..	..
Fe O .....	26.22	364	5	..	..	..	..	..	..	..	..	..
Ni O .....	1.01	13	..	..	..	..	77	875	..	..	1	874
Mn O .....	.68	10	..	..	..	..	..	..	..	..	..	..
Mg O .....	19.74	493	..	..	..	..	..	..	..	..	..	..
Ca O .....	5.45	97	..	..	..	20	77	..	..	76	1	..
Na <sub>2</sub> O .....	.62	10	..	..	10	..	..	..	..	..	..	..
K <sub>2</sub> O .....	.14	1	..	1	..	..	..	..	..	..	..	..
H <sub>2</sub> O .....	.16	..	..	..	..	..	..	..	..	..	..	..
Fe .....	2.59	..	..	..	..	..	..	..	..	..	..	..
Ni .....	.36	..	..	..	..	..	..	..	..	..	..	..
Co .....	.08	..	..	..	..	..	..	..	..	..	..	..
Cu .....	.01	..	..	..	..	..	..	..	..	..	..	..
Fe S .....	4.76	..	..	..	..	..	..	..	..	..	..	..
Graphite .....	.36	..	..	..	..	..	..	..	..	..	..	..
Sum .....	99.79	..	..	..	..	..	..	..	..	..	..	..

$$2x + 3y + \frac{z}{2} = 496 = \text{available Si O}_2$$

$$x + 4y = 77 = \text{molecules of Ca O}$$

$$x + z = 875 = \text{molecules of Mg O} + \text{Fe O}.$$

Whence,  $x = 1$  = diopside,  $y = 19$  = akermanite,  $z = 874$  = olivine.

Formula	Mol. Wt.		Norm	
K <sub>2</sub> O.Al <sub>2</sub> O <sub>3</sub> .4 Si O <sub>2</sub> ...	1 × 436	= leucite	= .44	{ L 3.28 }
Na <sub>2</sub> O.Al <sub>2</sub> O <sub>3</sub> .2 Si O <sub>2</sub> ...	10 × 284	= nephelite	= 2.84	{ F 5.56 }
Ca O.Al <sub>2</sub> O <sub>3</sub> .2 Si O <sub>2</sub> ...	20 × 278	= anorthite	= 5.56	{ Sal 8.84 }
{ Ca O.Si O <sub>2</sub> .....	{ 1 × 116 }	= diopside	= .24	P .24
{ Mg O.Si O <sub>2</sub> .....	{ 5 × 100 }			
{ Fe O.Si O <sub>2</sub> .....	{ 5 × 132 }	= olivine	= 73.40	{ O 81.08 }
{ 2 Mg O.Si O <sub>2</sub> .....	{ 492 × 70 }			
{ 2 Fe O.Si O <sub>2</sub> .....	{ 382 × 102 }	= akermanite	= 7.68	{ M 1.12 }
4 Ca O.3 Si O <sub>2</sub> .....	19 × 404			
Fe O.Cr <sub>2</sub> O <sub>3</sub> .....	5 × 224	= chromite	= 1.12	{ A 7.80 }
Fe S .....	..	= troilite	= 4.76	
Fe <sub>n</sub> N <sub>m</sub> .....	..	= nickel-iron	= 3.04	
		H <sub>2</sub> O	= .16	
		graphite	= .36	
			99.60	

$$\frac{\text{Sal}}{\text{Fem}} = \frac{8.84}{90.24} < \frac{1}{7}, \quad \frac{\text{POM}}{\text{A}} = \frac{82.44}{7.80} > \frac{7}{1}, \quad \frac{\text{PO}}{\text{M}} = \frac{81.32}{1.12} > \frac{7}{1}$$

$$\frac{\text{Perolic}}{\text{P}} = \frac{.24}{81.08} < \frac{1}{7}, \quad \frac{\text{Ca O} + \text{Mg O} + \text{Fe O}}{\text{Na}_2 \text{O}} = \frac{977}{10} > \frac{7}{1}, \quad \frac{\text{Mg O} + \text{Fe O}}{\text{Ca O}} = \frac{880}{97} > \frac{7}{1}$$

$$\frac{\text{Magnesiferrous}}{\text{Mg O}} = \frac{493}{387} < \frac{5}{3} > \frac{3}{5}$$



# ALPHABETICAL LIST OF THE STONE METEORITES ANALYSES OF WHICH ARE GIVEN

The numbers refer to the number of the analysis in the following table of analyses

Adare.....	74	Hessle.....	97, 113
Albareto.....	27	Homestead.....	104, 105
Alfianello.....	92, 111	Hvittis.....	64
Allegan.....	103	Ibbenbühen.....	33
Angra dos Reis.....	11	Jerome.....	61
Aussun.....	94, 109	Juvinas.....	1
Bachmut.....	69	Kaba.....	57
Beaver Creek.....	95	Kakova.....	58
Bishopville.....	32	Kernouvé.....	31
Bjurböle.....	18	Khetree.....	102
Blansko.....	112	Klein-Wenden.....	81
Bluff.....	55	Knyahinya.....	10
Borkut.....	29	Krähenberg.....	14, 68
Bremervörde.....	63	Lesves.....	15
Buschhof.....	114	Linum.....	13
Busti.....	36, 37	Lixna.....	99
Cabezzo de Mayo.....	118	Llano del Inca.....	30
Cape Girardeau.....	116	Long Island.....	49
Carcote.....	17	Lumpkin.....	106
Castalia.....	71	Lundsgard.....	25
Chandakapur.....	21	Manbhoom.....	48
Chateau Renard.....	56	Manegaum.....	34
Cold Bokkeveld.....	121	Marion.....	93
Constantinople.....	7	Marjalahti.....	125
Coon Butte.....	39	Mässing.....	3
Cynthiana.....	53	Mauerkirchen.....	45, 110
Dhurmsala.....	85	Meuselbach.....	24
Drake Creek.....	70	Mezö-Madaras.....	22
Dundrum.....	72	Middlesborough.....	41
Eli Elwah.....	62	Mincy.....	124
Ensisheim.....	79	Mocs.....	65
Ergheo.....	44	Modoc.....	67
Estacado.....	26	Mount Vernon.....	122
Farmington.....	107	Nerft.....	19
Felix.....	60	New Concord.....	46, 50
Forest City.....	115	Ngawi.....	40
Frankfort.....	2	Nowo-Urei.....	52
Gnadenfrei.....	77	Ogi.....	98
Gopalpur.....	73	Orgueil.....	78
Hendersonville.....	42	Ornans.....	120
Heredia.....	117	Orvinio.....	80

Parnallee.....	16	Shytal.....	119
Peramiho.....	5	Sokobanja.....	47
Petersburg.....	4	Ställdalen.....	76
Pickens County.....	28	Stannern.....	6
Pultusk.....	82, 101	Stawropol.....	12
Rakowka.....	20	Steinbach.....	123
Richmond.....	86	Tadjera.....	90
Rochester.....	84	Tieschitz.....	87
St. Christophe.....	89	Tokeuchimura.....	75
St. Denis-Westrem.....	88	Tourinnes-la-Grosse.....	23
St. Mark's.....	66	Travis County.....	43
Saline.....	96	Uden.....	9
Salt Lake City.....	100	Utrecht.....	108
Searsmont.....	83	Waconda.....	54
Shalka.....	35, 38	Warrenton.....	59
Shelburne.....	91	Zavid.....	51
Shergotty.....	8		

In some cases different analyses of the same meteorite require it to be placed in more than one group. Such cases indicate that further analyses are needed. In Busti for example there seems to be no way of determining whether Dancer's or Maskelyne's analysis is the more nearly correct and both must be used, but further analyses would probably furnish ground for eliminating one or the other. It is quite possible that a similar confusion would appear in terrestrial rocks if analyses of the same rock made at widely different times and by different analysts were compared. While some such discrepancies occur, in most cases plural analyses agree in placing the meteorite in the same group. This is true for example, of Homestead, New Concord, Aussun, Hessele, and others. In such cases the plurality of analyses happily confirms the placing of the meteorite. An opportunity for comparison of the grouping of meteorites in the quantitative classification with that of Rose, Tschermak, and Brezina is afforded by the Brezina symbol of each meteorite given in the tables. Comparison shows that on the whole the important groups of the German classification remain intact in the quantitative classification. Thus the howardities, eukrites, and chladnites occupy on the whole similar and separate places in both classifications. Among the subgroups of the chondrites little similarity of grouping in the two classifications can be noted, though the gray chondrites and spherical chondrites are rather more numerous among the less siliceous groups of the quantitative classification. This would be expected since the color and structure of the meteorites of these groups indicate a larger proportion of olivine than in the white or intermediate chondrites. Such a scattering of these groups, however, on



the whole emphasizes the impossibility of accurately classifying meteorites by their physical characters as has hitherto been attempted by the German system.

An interesting feature of the calculations is the indication which they afford of the presence of leucite or nephelite or both in some meteorites, such as Felix, Shytal, and Cold Bokkeveld. The calculation of these minerals was required by the low percentage of silica and suggests that a careful examination of the meteorites for these minerals, which have not been hitherto observed in meteorites, should be made. The most common meteorite type is seen from the tables to be that of Pultusk, perfemic, dosilicic, perpolc, pyrolic, permirlic, permiric, and domagnestic.

The Farmington type is also largely represented, differing from Pultusk only in being domolic instead of pyrolic. Further it will be seen by examining the tables that the great majority of meteorites are domagnestic and in making the calculations it was found that a proportion of Mg O to Fe O of very nearly 4:1 was highly preponderant and characteristic.

A summation of all the analyses, 125 in number, should give a fair average of the composition of stone meteorites. It gives the following result:

## AVERAGE COMPOSITION OF STONE METEORITES

Si O <sub>2</sub> .....	39.12
Al <sub>2</sub> O <sub>3</sub> .....	2.62
Fe <sub>2</sub> O <sub>3</sub> .....	.38
Cr <sub>2</sub> O <sub>3</sub> .....	.41
Fe O.....	16.13
Mn O.....	.18
Ni O.....	.21
Mg O.....	22.42
Ca O.....	2.31
Na <sub>2</sub> O.....	.81
K <sub>2</sub> O.....	.20
H <sub>2</sub> O.....	.20
Fe.....	11.46
Ni.....	1.15
Co.....	.05
S.....	1.98
P.....	.04
P <sub>2</sub> O <sub>5</sub> .....	.03
C.....	.06
Ni, Mn, Cu, Sn.....	.02
Ti O <sub>2</sub> .....	.02
Sn O <sub>2</sub> .....	.02
	<hr/> 99.82

The results agree very nearly with those obtained by Merrill\* by the addition of 99 analyses, the principal difference being a larger percentage of Ca O in the present writer's result. The present writer's method of determining the minor constituents differed from that of Merrill in that the present writer divided the totals of these constituents by the total number of analyses instead of by the number of analyses in which each constituent was reported. It is evident that the writer's method will produce too low a result, but the other method may give one too high, since the minor constituents may have been lacking in analyses in which they were not reported. It may further be suggested by way of discussion of the interesting comparison made by Merrill between stony meteorites and the earth's crust, that only the lighter and more siliceous meteorites should be used for such a comparison. Stony meteorites having large percentages of free metal have too high a specific gravity to be strictly comparable with the earth's crust. Again it should be recognized that the greater abundance of certain elements at the surface of the earth may be on account of their greater solubility. Thus limestones have grown successively more calcic and less magnesian since early times and an increase in the amount of soda and potash at the surface might take place in the same way. It does not appear that such a process would explain the discrepancy in the amount of alumina but it might act to increase the amount of silica. That the earth's crust of earlier times was more nearly meteoritic in composition than the present seems to be indicated by the great deposits of iron oxide of earlier ages and the fact that the early limestones are more magnesian than the modern.

Adding the analyses of iron meteorites p. 229 to those previously published, and omitting about 60 obviously imperfect ones, 318 analyses are obtained from which the average composition of iron meteorites can be calculated by summation. This sum is as follows:

## AVERAGE COMPOSITION OF IRON METEORITES

Fe.....	90.85
Ni.....	8.52
Co.....	.59
P.....	.17
S.....	.04
C.....	.03
Cu.....	.02
Cr.....	.01

100.23

\* Am. Jour. Sci. 1909, 4, 27, 471.



Combining this sum with that previously obtained from 125 analyses of stone meteorites, stone meteorites being here regarded as all those which have an appreciable quantity of silicates, the sum total gives according to Clarke's method\* the average composition of meteorites as a whole. The method is, of course, empirical, but seems to be the only one available in our present state of knowledge. This sum is the following:

## AVERAGE COMPOSITION OF METEORITES

Fe.....	68.43
Si O <sub>2</sub> .....	11.07
Ni.....	6.44
Mg O.....	6.33
Fe O.....	4.55
Al <sub>2</sub> O <sub>3</sub> .....	.74
Ca O.....	.65
S.....	.49
Co.....	.44
Na <sub>2</sub> O.....	.23
P.....	.14
Cr <sub>2</sub> O <sub>3</sub> .....	.12
Fe <sub>2</sub> O <sub>3</sub> .....	.11
Ni O.....	.06
K <sub>2</sub> O.....	.05
Mn O.....	.04
C.....	.04
Cu.....	.01
Cr.....	.01
P <sub>2</sub> O <sub>5</sub> .....	.01
Ti O <sub>2</sub> .....	.01
Sn O <sub>2</sub> .....	.01
<hr/>	
	99.98

The present writer has previously suggested,† that the average composition of meteorites may represent the composition of the earth as a whole. If so the proportions of the elements in the earth as a whole would be as follows:

PROPORTION OF ELEMENTS IN THE EARTH AS A WHOLE  
AS DEDUCED FROM METEORITES

Iron.....	72.06
Oxygen.....	10.10
Nickel.....	6.50
Silicon.....	5.20

\* Bull. U. S. Geol. Survey, 1891, 78, 33.

† Jour. Geol. 1901, 9, 630.

Magnesium.....	3.80
Sulphur.....	.49
Calcium.....	.46
Cobalt.....	.44
Aluminum.....	.39
Sodium.....	.17
Phosphorus.....	.14
Chromium.....	.09
Potassium.....	.04
Carbon.....	.04
Manganese.....	.03
Other elements.....	.05
	<hr/>
	100.00

The large proportion of iron in the constitution of the earth indicated by meteorites is in accord with the earth's density, rigidity, and magnetic proportions. Assuming the density of the rocks of the earth's crust to be 2.8, which may be too high, and combining with it metal of the density of 7.8, which is an average of the density of iron meteorites, it will be found that 77.58 per cent of metal will be required to obtain a density of 5.57, that of the earth as a whole. This is very nearly that of the sum of the metals in the above result after eliminating the proportions present as oxides. Such a proportion of iron would seem to be in accord, as has been stated, with the earth's rigidity and magnetic properties.



# SYNOPSIS OF METEORITE CLASSIFICATION

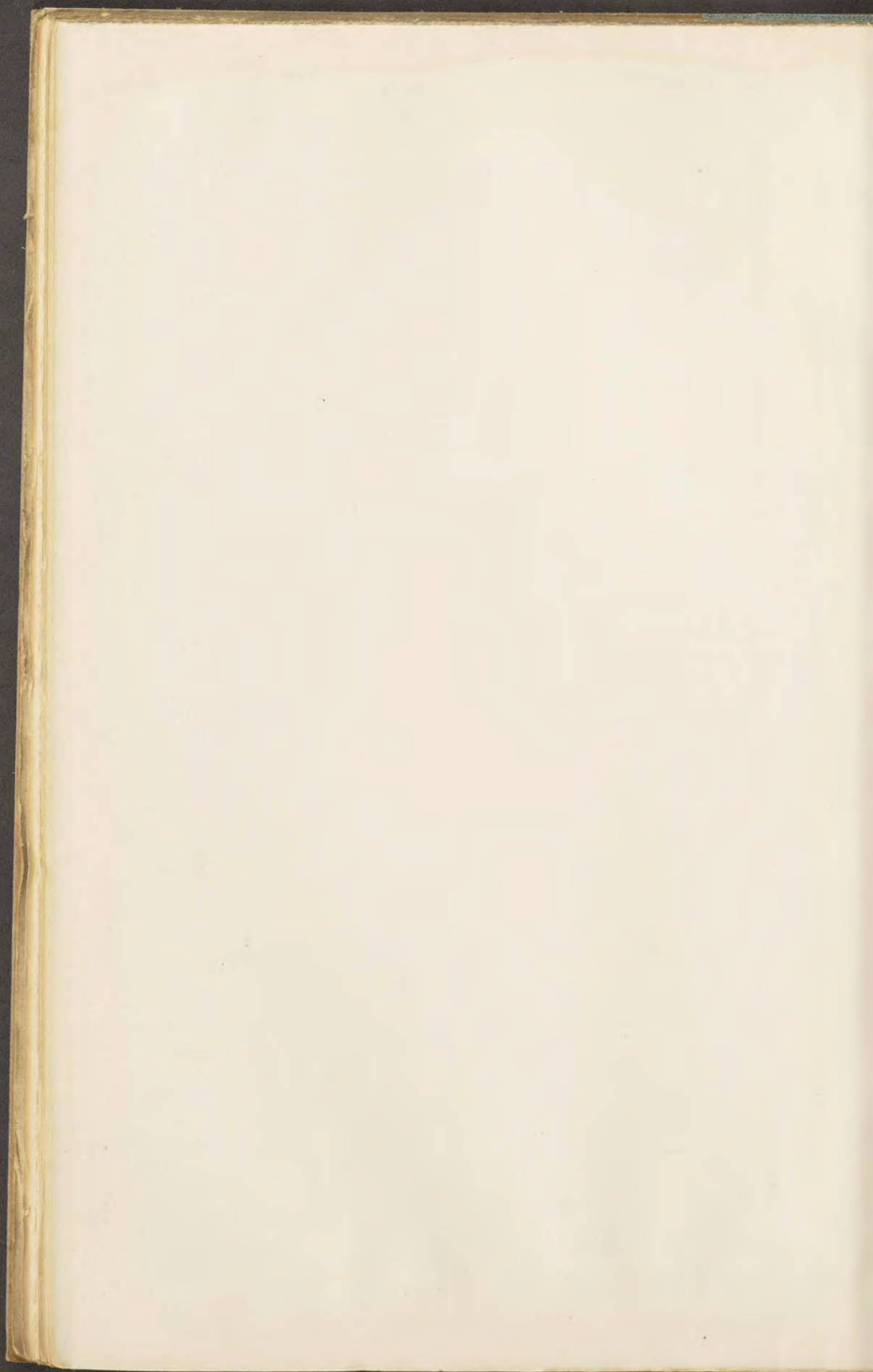
CLASS III.  $\frac{\text{Sal}}{\text{Fem}} < \frac{5}{3} > \frac{3}{5}$

SALFEMIC

SUBCLASS I.  $\frac{\text{QFL}}{\text{CZ}} > \frac{7}{1}$

PERQUARFELIC

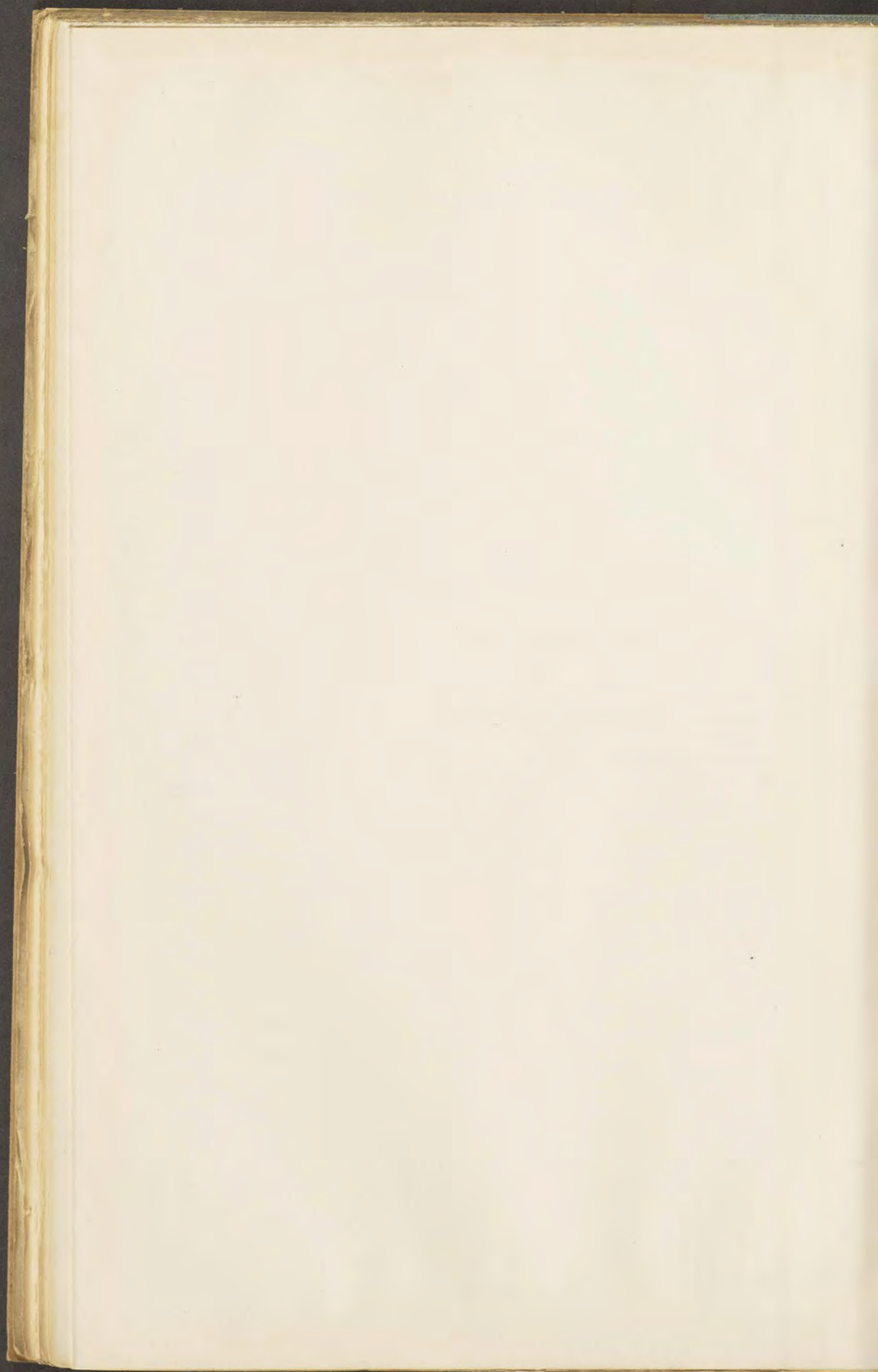
Order.....	$1. \frac{\text{Q}}{\text{F}} > \frac{7}{1}$ Perquaric	$2. \frac{\text{Q}}{\text{F}} < \frac{7}{1} > \frac{5}{3}$ Doquaric	$3. \frac{\text{Q}}{\text{F}} < \frac{5}{3} > \frac{3}{5}$ Quarfelic	$4. \frac{\text{Q}}{\text{F}} < \frac{3}{5} > \frac{1}{7}$ Quardofelic	$5. \frac{\text{QL}}{\text{F}} < \frac{1}{7}$ Perfelic
Rang 1. Peralkalic, $\frac{\text{K}_2\text{O} + \text{Na}_2\text{O}}{\text{CaO}} > \frac{7}{1}$					
Rang 2. Domalkalic, $\frac{\text{K}_2\text{O} + \text{Na}_2\text{O}}{\text{CaO}} < \frac{7}{1} > \frac{5}{3}$					
Rang 3. Alkalic, $\frac{\text{K}_2\text{O} + \text{Na}_2\text{O}}{\text{CaO}} < \frac{5}{3} > \frac{3}{5}$					
Rang 4. Docalcic, $\frac{\text{K}_2\text{O} + \text{Na}_2\text{O}}{\text{CaO}} < \frac{3}{5} > \frac{1}{7}$					
Rang 5. Percalcic, $\frac{\text{K}_2\text{O} + \text{Na}_2\text{O}}{\text{CaO}} < \frac{1}{7}$					Juvinose





CLASS IV.  $\frac{\text{Sal}}{\text{Fem}} < \frac{3}{5} > \frac{1}{7}$   
DOFEMIC

SUBCLASS I. $\frac{POM}{A} > \frac{7}{1}$ PERSILICIC						SUBCLASS II. $\frac{POM}{A} < \frac{7}{1} > \frac{5}{3}$ DOSILICIC									SUBCLASS III. $\frac{POM}{A} < \frac{7}{1} > \frac{5}{3}$ SILICOMETALLIC				
ORDER I. $\frac{P.O}{M} > \frac{7}{1}$ PERPOLIC						ORDER I. $\frac{P.O}{M} > \frac{7}{1}$ PERPOLIC					ORDER 2. $\frac{P.O}{M} < \frac{7}{1} > \frac{5}{3}$ DOPOLIC				ORDER I. $\frac{P.O}{M} > \frac{7}{1}$ PERPOLIC				
Section.....	1. $\frac{P}{O} > \frac{7}{1}$ Perpyric	2. $\frac{P}{O} < \frac{7}{1} > \frac{5}{3}$ Dopyric	3. $\frac{P}{O} < \frac{5}{3} > \frac{3}{5}$ Pyrolic	4. $\frac{P}{O} < \frac{3}{5} > \frac{1}{7}$ Domolic	5. $\frac{P}{O} < \frac{1}{7}$ Perolic	1. $\frac{P}{O} > \frac{7}{1}$ Perpyric	2. $\frac{P}{O} < \frac{7}{1} > \frac{5}{3}$ Dopyric	3. $\frac{P}{O} < \frac{5}{3} > \frac{3}{5}$ Pyrolic	4. $\frac{P}{O} < \frac{3}{5} > \frac{1}{7}$ Domolic	5. $\frac{P}{O} < \frac{1}{7}$ Perolic	1. $\frac{P}{O} > \frac{7}{1}$ Perpyric	2. $\frac{P}{O} < \frac{7}{1} > \frac{5}{3}$ Dopyric	3, 4 and 5 not represented	1. $\frac{P}{O} > \frac{7}{1}$ Perpyric	2. $\frac{P}{O} < \frac{7}{1} > \frac{5}{3}$ Dopyric	3. $\frac{P}{O} < \frac{5}{3} > \frac{3}{5}$ Pyrolic	4. $\frac{P}{O} < \frac{3}{5} > \frac{1}{7}$ Domolic	5. $\frac{P}{O} < \frac{1}{7}$ Perolic	
Rang I. Permirlic, $\frac{Ca\ O + Mg\ O + Fe\ O}{Na_2\ O} > \frac{7}{1}$ Section 1. Permiric, $\frac{Mg\ O + Fe\ O}{Ca\ O} > \frac{7}{1}$ Subrang 1. Permagnesic, $\frac{Mg\ O}{Fe\ O} > \frac{7}{1}$ Subrang 2. Domagnesic, $\frac{Mg\ O}{Fe\ O} < \frac{7}{1} > \frac{5}{3}$ Subrang 3. Magnesiferrous, $\frac{Mg\ O}{Fe\ O} < \frac{5}{3} > \frac{3}{5}$ Subrang 4. Doferrous, $\frac{Mg\ O}{Fe\ O} < \frac{3}{5} > \frac{1}{7}$ Subrang 5. Perferrous, $\frac{Mg\ O}{Fe\ O} < \frac{1}{7}$			Udenose		Stawropolose		Linumose Krahenbergose	Parnallose	Estacadose	Albaretose		Pickensose				Borkutose Incose	Kernouvose		
Section 2. Domiric, $\frac{Mg\ O + Fe\ O}{Ca\ O} < \frac{7}{1} > \frac{5}{3}$ Subrang 1. Permagnesic, $\frac{Mg\ O}{Fe\ O} > \frac{7}{1}$ Subrang 2. Domagnesic, $\frac{Mg\ O}{Fe\ O} < \frac{7}{1} > \frac{5}{3}$ Subrang 3. Magnesiferrous, $\frac{Mg\ O}{Fe\ O} < \frac{5}{3} > \frac{3}{5}$	Frankfortose																		
	Stannernose	Shergottose																	
Section 3. Calcimiric, $\frac{Mg\ O + Fe\ O}{Ca\ O} < \frac{5}{3} > \frac{3}{5}$ Subrang 1. Permagnesic, $\frac{Mg\ O}{Fe\ O} > \frac{7}{1}$ Subrang 2. Domagnesic, $\frac{Mg\ O}{Fe\ O} < \frac{7}{1} > \frac{5}{3}$ Subrang 3. Magnesiferrous, $\frac{Mg\ O}{Fe\ O} < \frac{5}{3} > \frac{3}{5}$ Subrang 4. Doferrous, $\frac{Mg\ O}{Fe\ O} < \frac{3}{5} > \frac{1}{7}$			Angrose																
	Constantino- plose																		

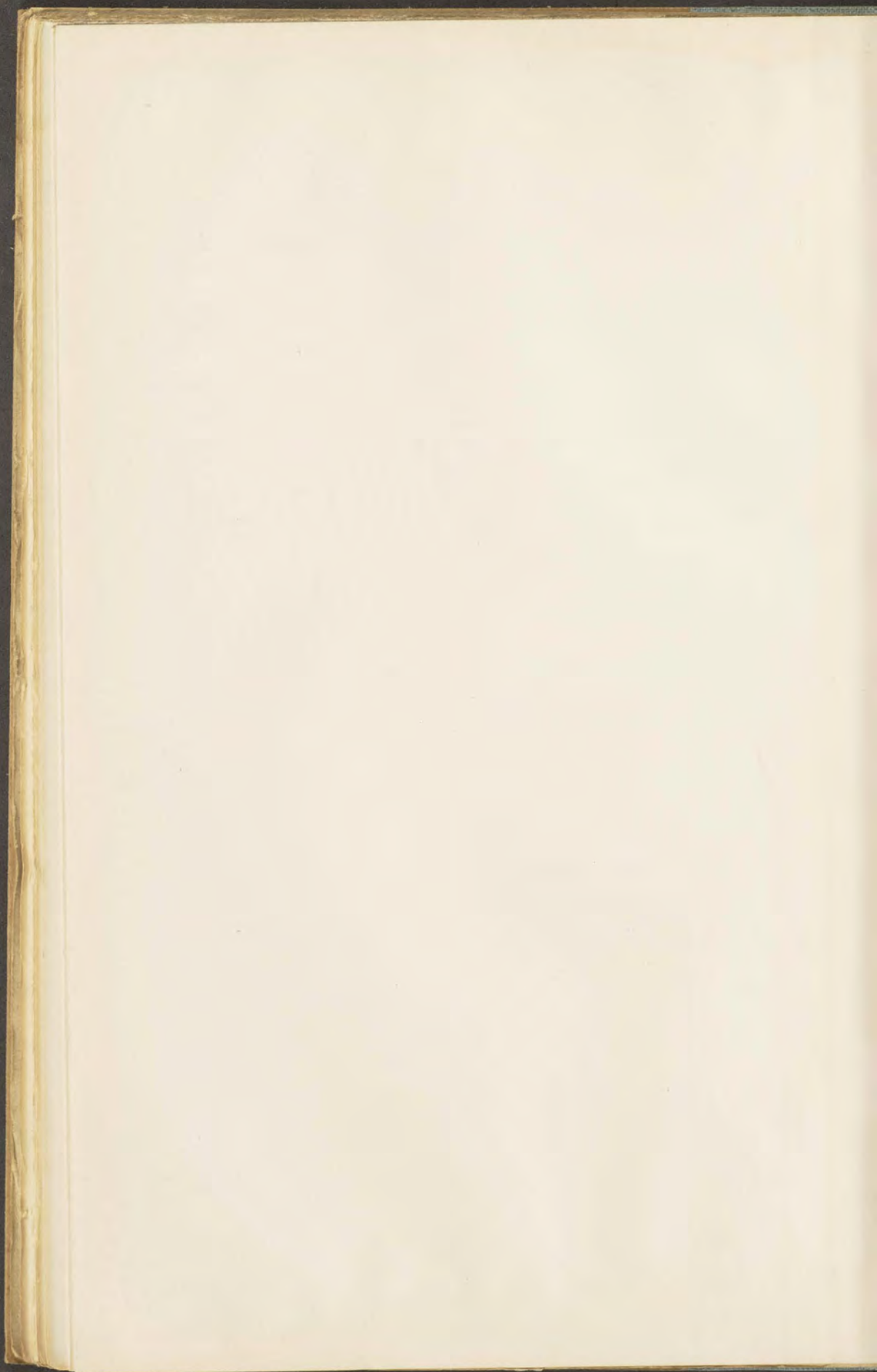




CLASS V.  $\frac{\text{Sal}}{\text{Fem}} < \frac{1}{7}$

PERFEMIC

Section .....	SUBCLASS I. $\frac{\text{POM}}{\text{A}} > \frac{7}{1}$					SUBCLASS II. $\frac{\text{POM}}{\text{A}} < \frac{7}{1} > \frac{5}{3}$					SUBCLASS III. $\frac{\text{POM}}{\text{A}} < \frac{5}{3} > \frac{3}{5}$					SUBCLASS IV. $\frac{\text{POM}}{\text{A}} < \frac{3}{5} > \frac{1}{7}$			
	PERSILICIC					DOSILICIC					SILICOMETALLIC					DOMETALLIC			
	ORDER 1. $\frac{\text{PO}}{\text{M}} > \frac{7}{1}$			ORDER 2. $\frac{\text{PO}}{\text{M}} < \frac{7}{1} > \frac{5}{3}$		ORDER 1. $\frac{\text{PO}}{\text{M}} > \frac{7}{1}$					Not represented					ORDER 1. $\frac{\text{PO}}{\text{M}} > \frac{7}{1}$			
	1. $\frac{\text{P}}{\text{O}} > \frac{7}{1}$	2. $\frac{\text{P}}{\text{O}} < \frac{7}{1} > \frac{5}{3}$	3. $\frac{\text{P}}{\text{O}} < \frac{5}{3} > \frac{3}{5}$	4. $\frac{\text{P}}{\text{O}} < \frac{3}{5} > \frac{1}{7}$	5. $\frac{\text{P}}{\text{O}} < \frac{1}{7}$	1. $\frac{\text{P}}{\text{O}} > \frac{7}{1}$	2. $\frac{\text{P}}{\text{O}} < \frac{7}{1} > \frac{5}{3}$	3. $\frac{\text{P}}{\text{O}} < \frac{5}{3} > \frac{3}{5}$	1. $\frac{\text{P}}{\text{O}} > \frac{7}{1}$	2. $\frac{\text{P}}{\text{O}} < \frac{7}{1} > \frac{5}{3}$	3. $\frac{\text{P}}{\text{O}} < \frac{5}{3} > \frac{3}{5}$	4. $\frac{\text{P}}{\text{O}} < \frac{3}{5} > \frac{1}{7}$	5. $\frac{\text{P}}{\text{O}} < \frac{1}{7}$			1. $\frac{\text{P}}{\text{O}} > \frac{7}{1}$	2. $\frac{\text{P}}{\text{O}} < \frac{7}{1} > \frac{5}{3}$	3 and 4 not represented	5. $\frac{\text{P}}{\text{O}} < \frac{1}{7}$
	Perpyric	Dopyric	Pyrolic	Domolic	Perolic	Perpyric	Dopyric	Pyrolic	Perpyric	Dopyric	Pyrolic	Domolic	Perolic			Perpyric	Dopyric		Perolic
Rang 1. Permirlic, $\frac{\text{Ca O} + \text{Mg O} + \text{Fe O}}{\text{Na}_2 \text{O}} > \frac{7}{1}$																			
Section 1. Permiric, $\frac{\text{Mg O} + \text{Fe O}}{\text{Ca O}} > \frac{7}{1}$																			
Subrang 1. Permagnesic, $\frac{\text{Mg O}}{\text{Fe O}} > \frac{7}{1}$	Bishopvillose	×							Hvittisose		Orviniose								Marjalahtose
Subrang 2. Domagnesic, $\frac{\text{Mg O}}{\text{Fe O}} < \frac{7}{1} > \frac{5}{3}$	Ibbenbührenose	Shalkose	Travisose	Wacondose	Kakovose				Mocsose	Castaliose	Pultuskose	Farmingtonose	Ornansose			Steinbachose	Minciose		
Subrang 3. Magnesiferrous, $\frac{\text{Mg O}}{\text{Fe O}} < \frac{5}{3} > \frac{3}{5}$		Middlesborose	Concordose	Kabose	Jeromose					Ensisheimose	Homesteadose								
Subrang 4. Doferrous, $\frac{\text{Mg O}}{\text{Fe O}} < \frac{3}{5} > \frac{1}{7}$																			
Subrang 5. Perferrous, $\frac{\text{Mg O}}{\text{Fe O}} < \frac{1}{7}$																			
Section 2. Domiric, $\frac{\text{Mg O} + \text{Fe O}}{\text{Ca O}} < \frac{7}{1} > \frac{5}{3}$																			
Subrang 1. Permagnesic, $\frac{\text{Mg O}}{\text{Fe O}} > \frac{7}{1}$	Bustose																		
Subrang 2. Domagnesic, $\frac{\text{Mg O}}{\text{Fe O}} < \frac{7}{1} > \frac{5}{3}$																			
Subrang 3. Magnesiferrous, $\frac{\text{Mg O}}{\text{Fe O}} < \frac{5}{3} > \frac{3}{5}$																			





# ANALYSES OF STONE METEORITES

COMPILED AND CLASSIFIED ACCORDING TO THE PRINCIPLES OF THE AMERICAN QUANTITATIVE CLASSIFICATION

## CLASS III

SALFEMIC, PERQUARFELIC, PERFELIC, PERCALCIC, JUVINOSE

Name	Si O <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe O	Mg O	Ca O	Na <sub>2</sub> O	K <sub>2</sub> O	Fe	Ni	Co	S	P	Miscellaneous	Sum	Sp. gr.	Noim	Brezina's Symbol	Analyst	Reference	
1. Juvinas.....	49.23	12.55	20.33	6.44	10.23	0.63	0.12	0.16	....	....	0.09	....	Fe <sub>2</sub> O <sub>3</sub> 1.21 Cr <sub>2</sub> O <sub>3</sub> 0.24	Ti O <sub>2</sub> 0.10 P <sub>2</sub> O <sub>5</sub> 0.28	101.61	3.12	<i>Q 2.2 di 14.4 or 0.6 hy 44.2 ab 5.2 mt 1.9 an 31.1</i>	Eu	C. Rammelsberg	Ann. Phys. Chem. 1848, 77, 585-590

## CLASS IV

DOFEMIC, PERSILICIC, PERPOLIC, PERPYRIC, PERMIRLIC, DOMIRIC, DOMAGNESIC, FRANKFORTOSE

2. Frankfort.....	51.33	8.05	13.70	17.59	7.03	0.45	0.22	tr	tr	.....	0.23	.....	Cr <sub>2</sub> O <sub>3</sub> 0.42	99.02	3.31	or 1.1 di 12.4 cm 0.7 ab 3.7 hy 50.4 tr 0.6 an 19.5 ol 6.3	Ho	G. J. Brush and W. J. Mixer	Am. Jour. Sci. 1869, 2, 48, 243
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DOFEMIC, PERSILICIC, FERPOLIC, PERPYRIC, PERMIRLIC, DOMIRIC, MAGNESIFERROUS, STANNERNOSE

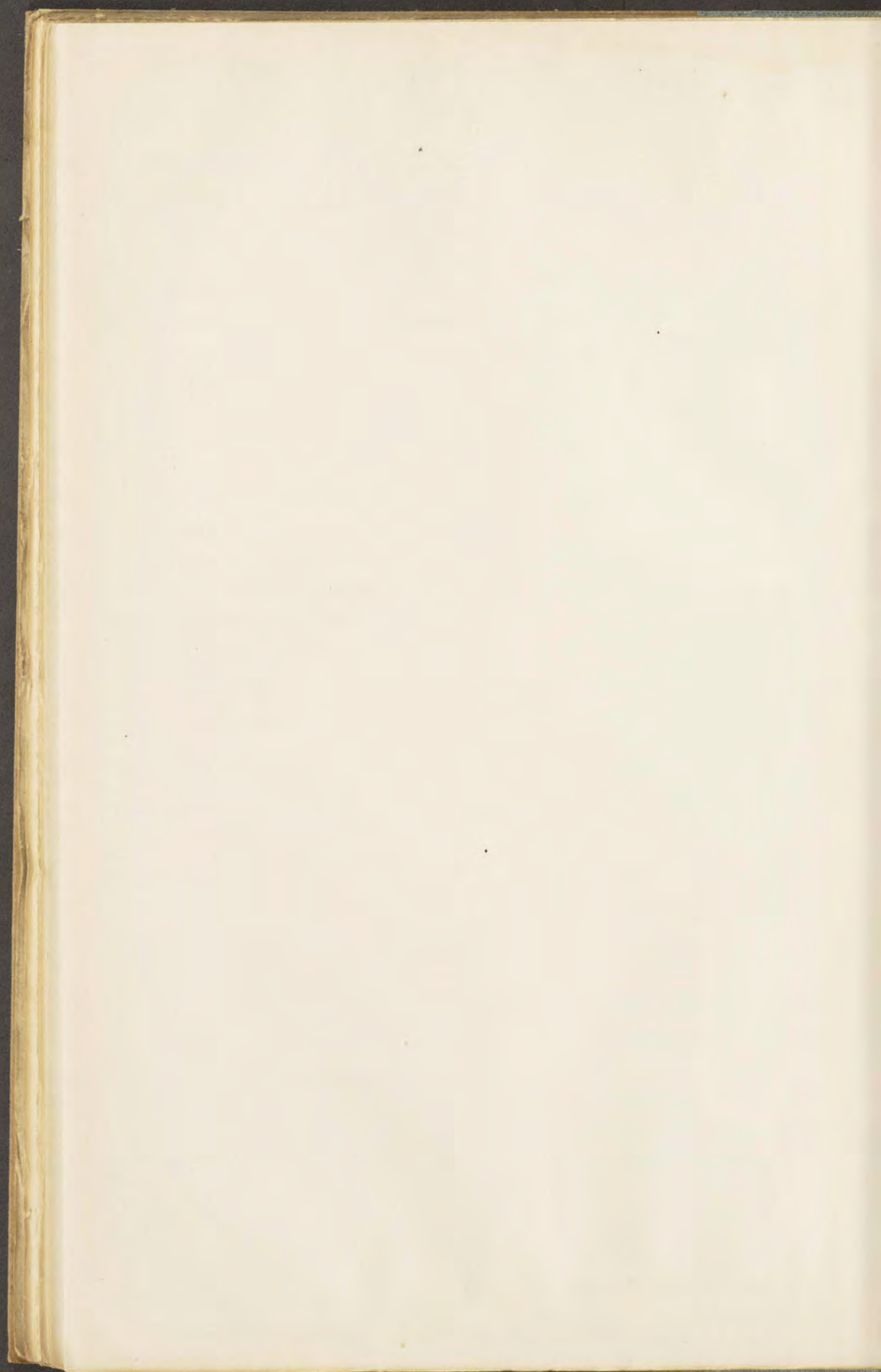
3. Mässing.....	53.12	8.20	19.14	8.48	5.79	1.93	1.19	0.52	.....	.....	0.37	.....	Cr <sub>2</sub> O <sub>3</sub> 0.98	99.72	3.36	Q 1.3 di 15.0 cm 1.6 or 7.2 hy 45.8 tr 1.1 ab 16.2 nf 0.6 an 10.0	Ho	A. Schwager.....	Sitzber. München Akad. 1878, 8, 32-40
4. Petersburg.....	49.21	11.05	20.41	8.13	9.01	0.82	.....	0.50	tr	.....	0.06	.....	.....	99.23	3.20	Q 0.1 di 15.5 tr 0.2 ab 6.8 hy 49.5 nf 0.5 an 26.4	Ho	J. L. Smith.....	Am. Jour. Sci. 1861, 2, 31, 265
5. Peramiho.....	49.32	11.24	20.65	7.15	10.84	0.40	0.25	.....	.....	.....	0.23	.....	Ti O <sub>2</sub> 0.42	100.50	.....	Q 1.2 di 21.7 il 0.8 or 1.7 hy 43.3 tr 0.6 ab 3.1 an 28.1	Eu	E. Ludwig.....	Sitzber. Wien Akad. 1903, 112, 739-777
6. Stannern.....	48.30	12.65	19.32	6.87	11.27	0.62	0.23	.....	.....	.....	tr	.....	Chromite 0.54 Mn O 0.81	100.61	3.05	or 1.1 d 20.0 cm 0.5 ab 5.2 hy 35.0 an 31.1 ol 5.6	Eu	C. Rammelsberg	Ann. Phys. Chem. 1851, 83, 591-593

DOFEMIC, PERSILICIC, PERPOLIC, PERPYRIC, PERMIRLIC, CALCIMIRIC, DOFERROUS, CONSTANTINOPLOSE

7. Constantinople....	48.59	12.63	20.99	6.16	10.39	0.46	0.16	.....	.....	.....	.....	.....	Cr <sub>2</sub> O <sub>3</sub> 0.44 Mn O tr	99.82	.....	Q 0.5 di 16.8 or 1.1 hy 45.3 ab 3.7 cm 0.4 an 32.0	Eu	G. Tschermak....	Min. Mitth. 1872, 2, 85
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DOFEMIC, PERSILICIC, PERPOLIC, DOPYRIC, PERMIRLIC, DOMIRIC, MAGNESIFERROUS, SHERGOTTSE

8. Shergotty.....	50.21	5.90	21.85	10.00	10.41	1.28	0.57	.....	.....	.....	.....	.....	.....	100.22	.....	or 3.3 di 36.2 ab 11.0 hy 21.5 an 8.6 ol 16.7	She	E. Lumpe.....	Min. Mitth. 1871, 55-56
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## ANALYSES OF STONE METEORITES—Continued

## DOFEMIC, PERSILICIC, PERPOLIC, PYROLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, UDENOSE

Name	Si O <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe O	Mg O	Ca O	Na <sub>2</sub> O	K <sub>2</sub> O	Fe	Ni	Co	S	P	Miscellaneous	Sum	Sp.gr.	Norm	Brezina's Symbol	Analyst	Reference
9. Uden.....	44.58	4.10	22.41	20.67	2.28	0.94	0.49	1.77			Fe S 0.72		Chromite 0.76 Mu O 0.43 Ni O 0.29	99.44	3.40	or 2.8 di 4.8 cm 0.8 ab 7.9 hy 29.7 tr 0.7 an 5.6 ol 45.4 nf 1.8	Cwb	Baumhauer and Seelheim.....	Ann. Phys. Chem. 1862, 116, 185-188
10. Knyahinya.....	44.30	3.06	16.38	22.16	2.73	1.00	0.66	5.00			Fe S 2.22		Chromite 0.80	98.31	3.52	or 3.9 di 9.5 cm 0.8 ab 8.4 hy 28.0 tr 2.2 an 2.0 ol 37.6 nf 5.0	Cg	E. H. von Baumhauer.....	Arch. Neerland, 1872, 7, 146-153, Mass anal. calc. by Wadsworth

## DOFEMIC, PERSILICIC, PERPOLIC, PYROLIC, PERMIRLIC, CALCIMIRIC, DOMAGNESIC, ANGROSE

11. Angra dos Reis....	43.94	8.73	8.28	10.05	24.51	0.26	0.19	0.81	....	....	0.45	....	Fe <sub>2</sub> O <sub>3</sub> 0.31 Ti O <sub>2</sub> 2.39 P <sub>2</sub> O <sub>5</sub> 0.13	100.05	...	lc 0.0 di 35.1 ml 0.5 ne 1.1 ol 15.7 ap 0.3 an 22.0 am 20.2 tr 1.3 nf 0.8	Angrite	Ludwig and Tschermak	Min. u. petr. Mitth. N. F. 1909, 28, 113
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## DOFEMIC, PERSILICIC, PERPOLIC, PEROLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, STAWROPOLOSE

12. Stawropol.....	33.16	4.22	18.59	29.24	1.20	1.40	0.60	4.32	....	....	1.60	....	Ni O 3.81 Sn O <sub>2</sub> 1.10	99.24	3.59	lc 2.6 ol 71.0 tr 4.4 ne 6.5 am 0.8 nf 4.3 an 3.3 mo 4.3	Ck	H. Abich.....	Bull. Akad. St. Petersburg, 1860, 1862, 403-422, 433-439
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## DOFEMIC, DOSILICIC, PERPOLIC, DOPYRIC, PERMIRLIC, PERMIRIC, PERMAGNESIC, LINUMOSE

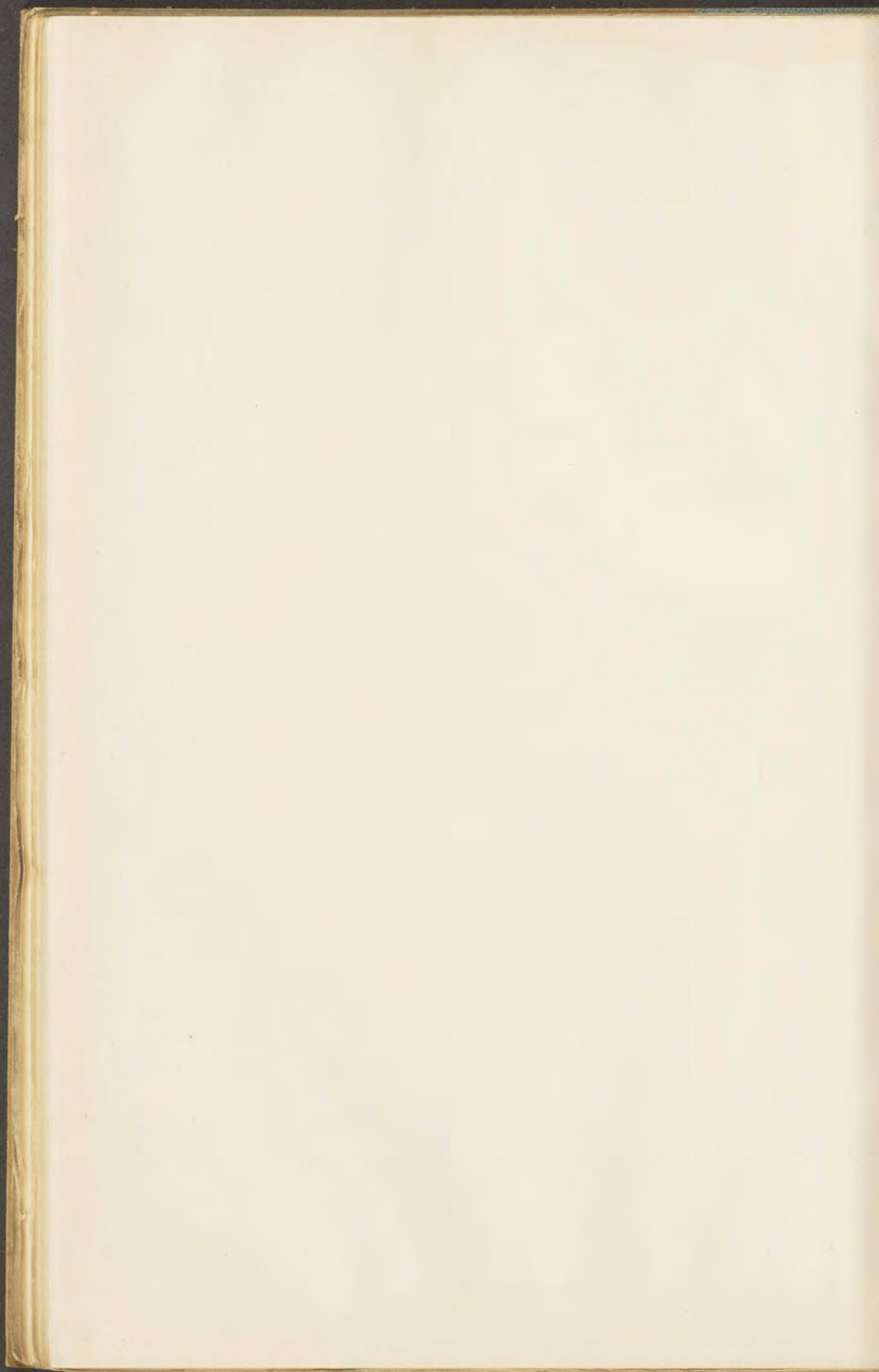
13. Linum.....	43.05	2.44	1.32	25.72	3.49	1.39	0.26	15.83	0.71	....	1.85	0.07	Cr <sub>2</sub> O <sub>3</sub> 0.31 Mn O 0.20 H <sub>2</sub> O 0.12 Fe S 3.23	99.99	3.54	or 1.6 ns 0.2 cm 0.5 ab 11.0 di 5.0 tr 1.5 hy 43.0 ol 2.9 ol 13.3 nf 16.5	Cw	Lindner.....	Sitzber, Berlin Akad. 1904, 114-153
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## DOFEMIC, DOSILICIC, PERPOLIC, DOPYRIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, KRÄHENBERGLOSE

14. Krähenberg.....	41.12	3.22	17.42	18.62	2.06	0.17	1.22	10.37	1.36	....	2.35	0.46	Cr <sub>2</sub> O <sub>3</sub> 0.80 Mn O 0.78 Sn O <sub>2</sub> 0.18	100.22	...	or 7.2 di 4.9 cm 1.3 ab 1.6 hy 44.8 tr 6.4 an 4.2 ol 16.2 nf 11.7	Cho	Keller.....	Sitzber, München Akad. 1878, 8, 47-58
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## DOFEMIC, DOSILICIC, PERPOLIC, PYROLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, PARNALLOSE

15. Lesves.....	39.46	3.33	15.82	22.75	1.54	1.05	0.09	12.36	1.37	0.11	2.25	....	Cr <sub>2</sub> O <sub>3</sub> 1.02	101.15	3.58	or 0.6 di 3.1 cm 1.6 ab 8.9 hy 30.9 tr 6.2 an 3.9 ol 31.0 nf 13.8	Cw	A. F. Renard.....	Bull. de l'Acad. roy. de Belgique, 1896, 3, 31, 654-663
16. Parnallee.....	39.41	2.57	15.28	22.82	0.56	1.91	0.55	9.83	0.90	0.06	2.71	0.10	Mn O 0.54 H <sub>2</sub> O 0.68 Ni O 0.72 Co O 0.06	98.70	3.12	or 2.8 ns 1.3 tr 7.4 ab 10.5 di 2.2 tr 10.8 hy 25.8 ol 34.5	Cga	E. Pfeiffer.....	Sitzber, Wien. Akad. 1863, 47, 2, 460-463
17. Carcote.....	39.28	2.39	14.29	22.79	1.19	1.40	0.30	8.95	0.91		Fe S 5.98	0.21	Chromite 1.43 Cu+Sn 0.06 Mn 0.14 C 0.19 Res 0.49	100.00	3.47	or 1.7 ns 0.2 cm 1.4 ab 11.0 di 4.7 tr 6.0 hy 22.3 nf 10.1 ol 40.4	Ck	Will.....	Neues Jahrb. 1889, 2, 177-179, Mass anal. calc. by Farrington





## ANALYSES OF STONE METEORITES—Continued

## DOFEMIC, DOSILICIC, PERPOLIC, DOMOLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, ESTACADOSE

Name	Si O <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe O	Mg O	Ca O	Na <sub>2</sub> O	K <sub>2</sub> O	Fe	Ni	Co	S	P	Miscellaneous	Sum	Sp. gr.	Norm	Brezina's Symbol	Analyst	Reference
18. Bjurböle.....	41.06	2.55	13.80	25.75	1.82	1.24	0.32	6.38	0.72	0.04	5.44	0.14	Cr <sub>2</sub> O <sub>3</sub> 0.59 Mn O 0.12 Ni O 0.07	100.04	...	or 1.7 di 6.3 cm 0.0 ab 10.5 hy 18.4 tr 5.4 an 0.6 ol 47.8 nf 7.1	Cca	Ramsay and Borgström....	Bull. Com. Geol. de Finland, 1902, 12, 13
19. Nerft.....	40.00	3.52	15.98	25.59	0.05	1.65	0.08	8.36	1.32	tr	2.02	0.05	Chromite 0.65 Mn O 0.03 Mn 0.10	99.40	...	or 0.6 hy 21.1 cm 0.7 ab 14.1 ol 45.2 tr 5.5 an 0.3 nf 9.8 C 0.5	Cia	A. Kuhlberg.....	Ann. Phys. Chem. 1869 136, 448-449
20. Rakowka.....	38.87	2.66	13.44	24.60	2.36	2.04	0.37	5.67	1.43	0.32	6.16	0.12	Co 0.13 Mn tr	99.22	3.58	or 2.2 ns 1.3 cm 0.8 ab 11.5 di 0.4 sc 0.8 hy 5.2 tr 6.2 ol 54.0 nf 7.4	Ci	P. Grigorieux....	Zeitschr. deutsch. Geol. Gesell. 1880, 32, 417-420
21. Chandakapur.....	38.02	4.17	19.81	21.31	2.42	1.26	0.29	5.25	0.55		4.92	1.06	Chromite 0.51 Ni O 0.07	99.94	...	or 1.7 di 5.7 mt 0.3 ab 10.5 hy 4.0 cm 0.5 an 5.0 ol 60.5 sc 1.1 tr 4.0 nf 5.8	Cib	H. E. Clarke....	Min. Mag. 1910, 15, 371
22. Mezö-Madaras....	37.64	3.41	15.44	24.11	1.68	1.76	tr	12.12	1.64	....	2.27	....	Chromite 0.54 Mn O 0.18 Ni O 0.06	100.85	...	ab 14.8 di 5.6 cm 0.7 an 1.4 hy 8.1 tr 6.3 ol 40.1 nf 13.8	Cgb	C. Rammelsberg.	Zeitschr. deutsch. Geol. Gesell. 1871, 23, 734-737. Mass anal. calc. by Wadsworth
23. Tourinnes-la-Grosse	37.47	3.65	13.89	24.40	2.61	2.26		11.05	1.30	....	2.21	....	Chromite 0.71 Sn 0.17	99.72	3.53	ab 15.2 ns 0.1 cm 0.7 ne 2.0 di 10.2 tr 6.1 ol 51.9 nf 12.5	Cw	F. Pisani.....	Comptes Rendus, 1864, 58, 169-171
24. Meuselbach.....	37.30	2.89	16.20	24.55	1.72	1.32	....	6.71	1.07	0.11	7.79	....	Chromite 0.34 Cn tr	100.00	...	ab 11.0 di 5.2 cm 0.3 an 2.0 hy 6.1 tr 7.8 ol 59.7 nf 7.9	Ccka	G. Linck.....	Ann. Wien. Mus. 1899, 13, 103-114. Mass anal. calc. by Farrington
25. Lundsgård.....	36.97	2.70	13.18	23.79	1.40	1.42	0.43	14.46	1.91	0.02	2.38	0.10	Chromite 0.59 Ni O 0.05 H <sub>2</sub> O 0.50 Cu 0.04 C 0.02	99.96	3.61	or 2.2 ns 0.1 cm 0.0 ab 11.5 di 5.5 tr 6.5 hy 15.8 sc 0.6 ol 38.4 nf 10.4	Cw	O. Nordenskjöld.	Geol. Foren. i Stockholm, Förh. 1891, 13, 470-475
26. Estacado.....	35.82	3.60	15.53	22.74	2.99	2.07	0.32	14.68	1.60	0.08	1.37	0.15	Cr <sub>2</sub> O <sub>3</sub> tr Mn O tr Ti O <sub>2</sub> tr Cu tr	100.95	3.60	or 1.7 ns 0.1 tr 3.8 ab 9.4 di 12.0 sc 1.0 ne 4.0 ol 51.5 nf 16.4	Ckb	J. M. Davison...	Am. Jour. Sci. 1906, 3, 22, 59

## DOFEMIC, DOSILICIC, PERPOLIC, PEROLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, ALBARETOSE

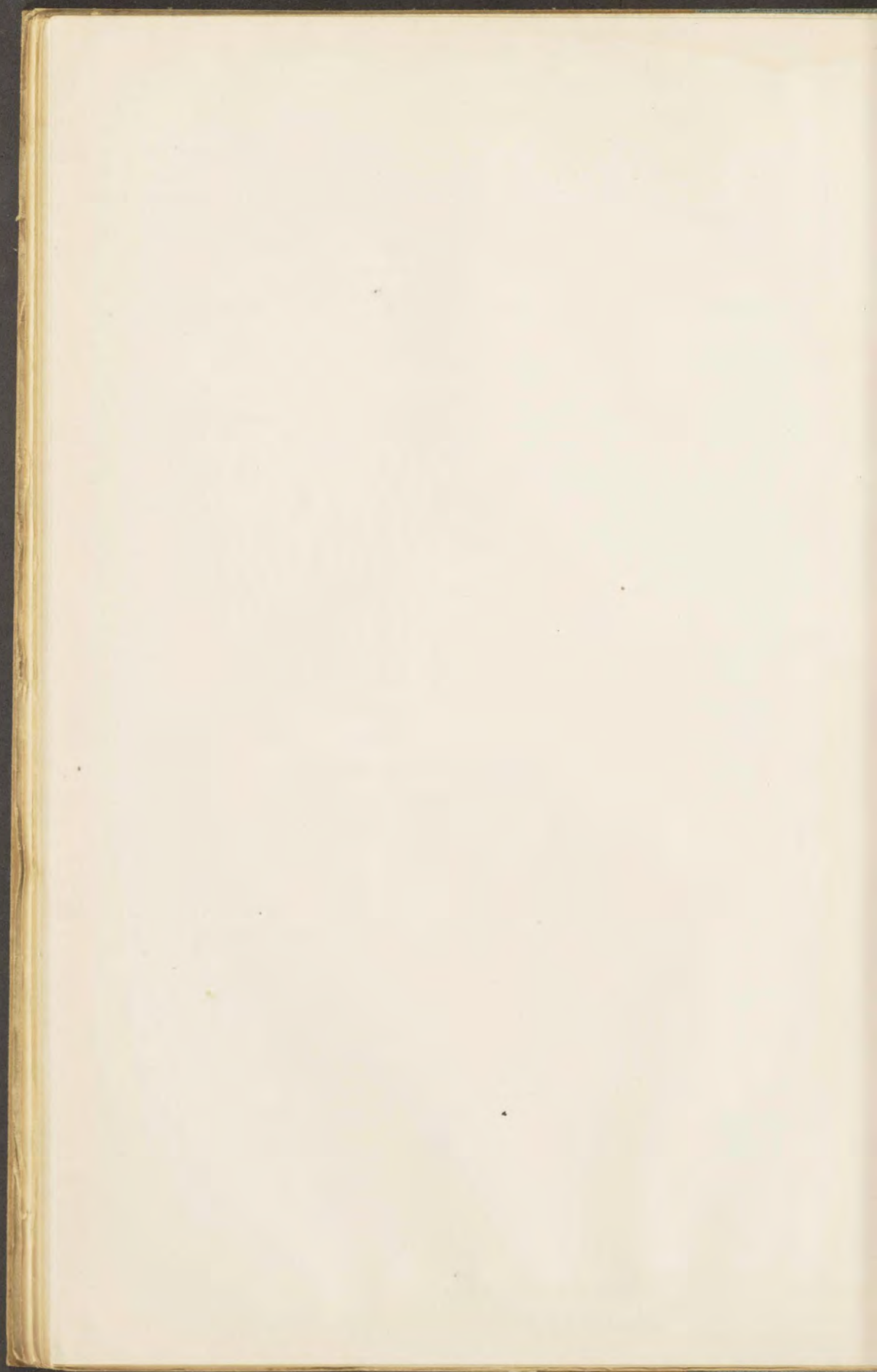
27. Albareto.....	35.91	4.48	24.31	22.77	2.07	1.64	0.44	4.33	0.73	0.11	2.37	....		99.16	...	or 2.2 di 5.2 tr 6.5 ab 5.8 ol 64.8 nf 5.2 ne 4.3 an 4.9	Cc	P. Maissen.....	Gazetta Chimica, 1880, 10, 20
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## DOFEMIC, DOSILICIC, DOPOLIC, DOPYRIC, PERMIRLIC, PERMIRIC, PERMAGNESIC, PICKENSOSE

28. Pickens County...	37.06	5.83	9.63	24.00	0.55	0.92	0.02	8.22	1.23	0.11	1.57	....	Fe <sub>2</sub> O <sub>3</sub> 10.69 Mn O 0.40 Cr O 0.36 Cu O 0.06	101.05	...	ab 7.9 hy 42.0 mt 15.5 an 0.8 ol 15.2 il 0.2 C 4.0 ap 9.7 tr 4.3 nf 9.6	....	E. Everhart.....	Science, 1909, N. S. 30, 772
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## DOFEMIC, SILICOMETALLIC, PERPOLIC, PYROLIC, PERMIRLIC, PERMIRIC, PERMAGNESIC, BORKUTOSE

29. Borkut.....	35.28	2.74	4.71	19.92	1.95	1.91	0.66	27.03	1.84	0.89	0.03		Chromite 0.61 Cu + Sn 0.08 Ni + Mn 0.78	98.46	...	or 3.9 ns 1.3 cm 0.6 ab 10.0 di 7.6 tr 2.5 hy 20.7 nf 20.7 ol 21.2	Cc	J. Nuricsany.....	Sitzb. Wien. Akad. 1856, 20, 308-406. Mass anal. calc. by Wadsworth
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## ANALYSES OF STONE METEORITES—Continued

## DOFEMIC, SILICOMETALLIC, PERPOLIC, PYROLIC, PERMIRLIC, PERMIRIC, MAGNESIFEROUS, INCOSE

Name	Si O <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe O	Mg O	Ca O	Na <sub>2</sub> O	K <sub>2</sub> O	Fe	Ni	Co	S	P	Miscellaneous	Sum	Sp. gr.	Norm	Brezina's Symbol	Analyst	Reference
30. Llano del Inca.....	26.02	4.70	19.29	8.15	3.45	....	....	23.29	2.38	0.16	Fe S 10.61	....	Cr <sub>2</sub> O <sub>3</sub> 0.29 Mn O 0.06 Ni O 0.90 P <sub>2</sub> O <sub>5</sub> 0.70	100.00	...	an 12.8 hy 27.6 ap 1.7 ol 22.1 fr 10.6 cm 0.5 nf 25.8	M	L. G. Eakins.....	Proc. Rochester Acad. Sci. 1890, 1, 94. Mass anal. calc. by Farrington

## DOFEMIC, SILICOMETALLIC, PERPOLIC, DOMOLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, KERNOUVOSE

31. Kernouvé.....	32.95	3.19	11.70	23.68	1.89	1.41	22.25	1.55	....	2.15	....	....	....	100.77	3.75	ab 12.1 di 5.8 tr 6.1 an 2.2 hy 2.5 nf 23.8 ol 47.5	Ck	F. Pisani.....	Comptes Rendus, 1869, 68, 1480-1491
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## PERFEMIC, PERSILICIC, PERPOLIC, PERPYRIC, PERMIRLIC, PERMIRIC, PERMAGNESIC, BISHOPVILLE

32. Bishopville.....	59.97	....	....	39.34	....	0.74	tr	....	....	....	....	....	Fe <sub>2</sub> O <sub>3</sub> 0.40 Li <sub>2</sub> O tr	100.45	...	ac 0.9 mo 0.1 ns 1.2 hy 98.1	Chla	J. L. Smith.....	Am. Jour. Sci. 1864, 2, 38, 225
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## PERFEMIC, PERSILICIC, PERPOLIC, PERPYRIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, IBHENBÜHRENOSE

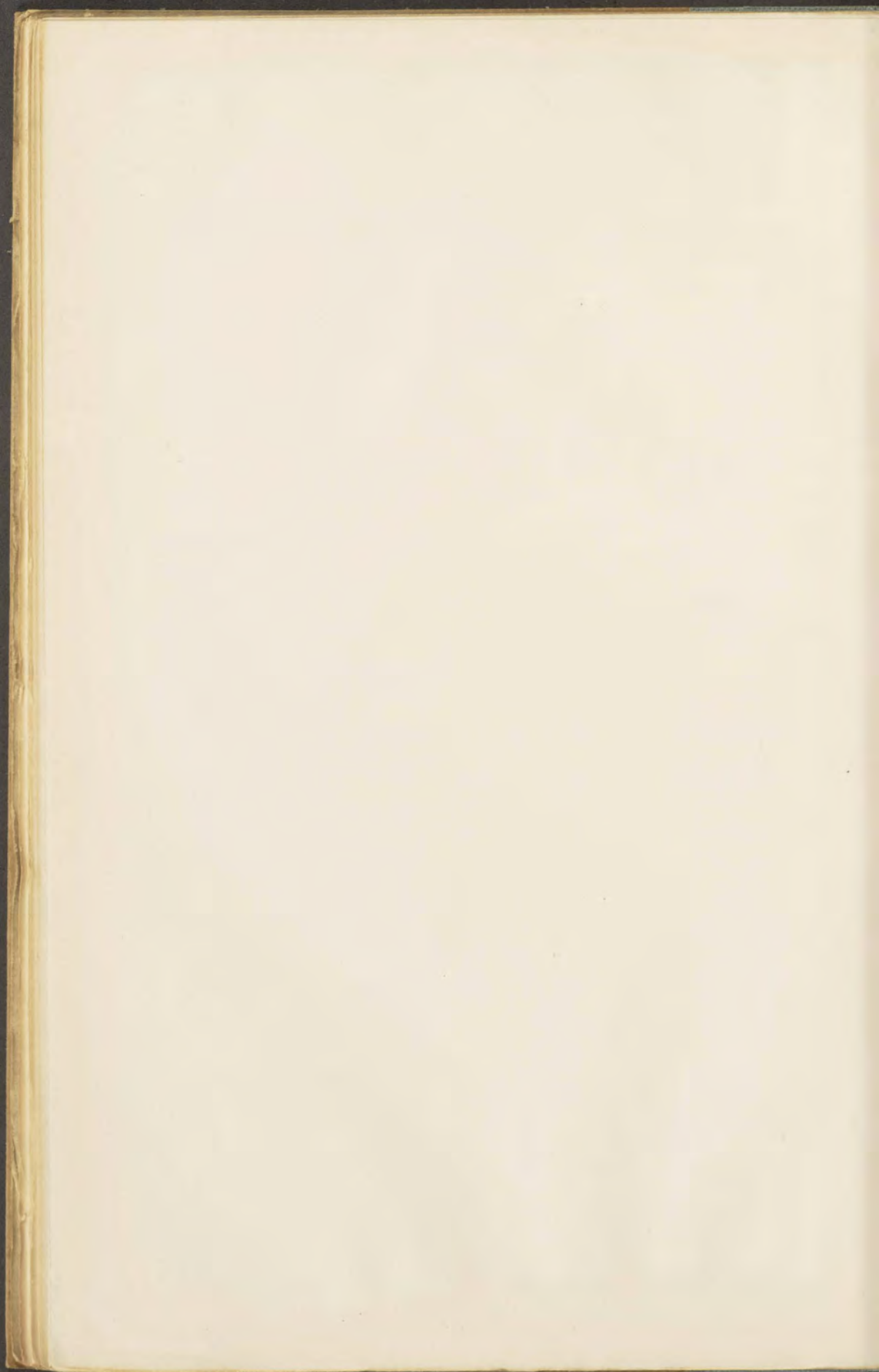
33. Ibbenbühen.....	54.49	1.06	17.34	26.12	1.22	....	....	....	....	....	....	....	Mn O 0.28	100.51	3.41	an 3.1 di 2.3 hy 91.7 ol 3.5	Chl	G. von Rath....	Sitzber. nieder. Gesell. Bonn, 1871, 28, 142-145
34. Manegaum.....	53.63	....	20.48	23.32	1.40	....	....	....	....	....	....	....	Chromite 1.03	99.95	3.20	di 6.1 cm 1.0 hy 92.9	Chl	.....	N. S. Maskelyne, Phil. Trans. 1870, 109, 211-213
35. Shalka.....	52.64	....	19.78	26.38	0.55	0.40	....	....	....	....	....	....	Cr <sub>2</sub> O <sub>3</sub> 0.23	99.98	3.41	ns 0.7 cm 2.2 di 2.3 hy 85.2 ol 11.4	Chl	C. Rammelsberg	Monatsber. Berlin Akad. 1870, 316-322

## PERFEMIC, PERSILICIC, PERPOLIC, PERPYRIC, PERMIRLIC, DOMIRIC, PERMAGNESIC, BUSTOSE

36. Busti.....	52.87	....	0.19	28.32	12.40	0.57	0.24	....	....	....	....	....	Ca S 4.13 Li <sub>2</sub> O 0.02 Ca S O <sub>4</sub> 0.44	99.18	...	ks 0.3 oh 4.1 ns 1.1 di 47.7 hy 36.6 ol 8.7	Bu	N. S. Maskelyne	Phil. Trans. 1870, 140, 193-211
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## PERFEMIC, PERSILICIC, PERPOLIC, DOPYRIC, PERMIRLIC, PERMIRIC, PERMAGNESIC

37. Busti.....	52.73	....	4.28	37.22	1.18	....	tr	....	....	....	....	....	Ni O 0.78 Na <sub>2</sub> S 0.76 Mn O 0.01 Apatite tr H <sub>2</sub> O 0.92 Ca S O <sub>4</sub> 1.58 Li <sub>2</sub> O tr Ca Cl <sub>2</sub> 0.01	99.47	...	di 4.6 hy 71.0 ol 20.7	Bu	W. Dancer.....	Phil. Trans. 1870, 140, 193-211
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## ANALYSES OF STONE METEORITES—Continued

## PERFEMIC, PERSILICIC, PERPOLIC, DOPYRIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, SHALKOSE

Name	Si O <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe O	Mg O	Ca O	Na <sub>2</sub> O	K <sub>2</sub> O	Fe	Ni	Co	S	P	Miscellaneous	Sum	Sp. gr.	Norm	Brezina's Symbol	Analyst	Reference
38. Shalka.....	52.51	0.66	16.81	28.35	0.89	0.22	.....	.....	.....	.....	Fe S 0.39	tr	Cr <sub>2</sub> O <sub>3</sub> 1.25	101.08	...	ab 1.6 di 2.7 cm 1.8 an 1.1 hy 78.4 tr 0.4 ol 15.1	Chl	H. B. von Foullon.....	Ann. Wien. Mus. 1888, 3, 195-208
39. Coon Butte.....	42.62	1.69	12.98	26.55	0.96	0.40	0.12	7.71	0.93	0.01	Fe S 2.15	Fe <sub>3</sub> P 0.76	Fe <sub>2</sub> O <sub>3</sub> 2.60 Chromite 0.08 Cu, Mn, Sn, tr	100.00	3.47	or 0.6 di 1.5 ml 3.7 ab 3.1 hy 47.5 tr 2.2 an 2.8 ol 29.3 sc 0.8 nf 7.7	Cib	J. W. Mallet....	Am. Jour. Sci. 1906, 4, 21, 353. Mass anal. calc. by Farrington

## PERFEMIC, PERSILICIC, PERPOLIC, DOPYRIC, PERMIRLIC, PERMIRIC, MAGNESIFERROUS, MIDDLESBOROSE

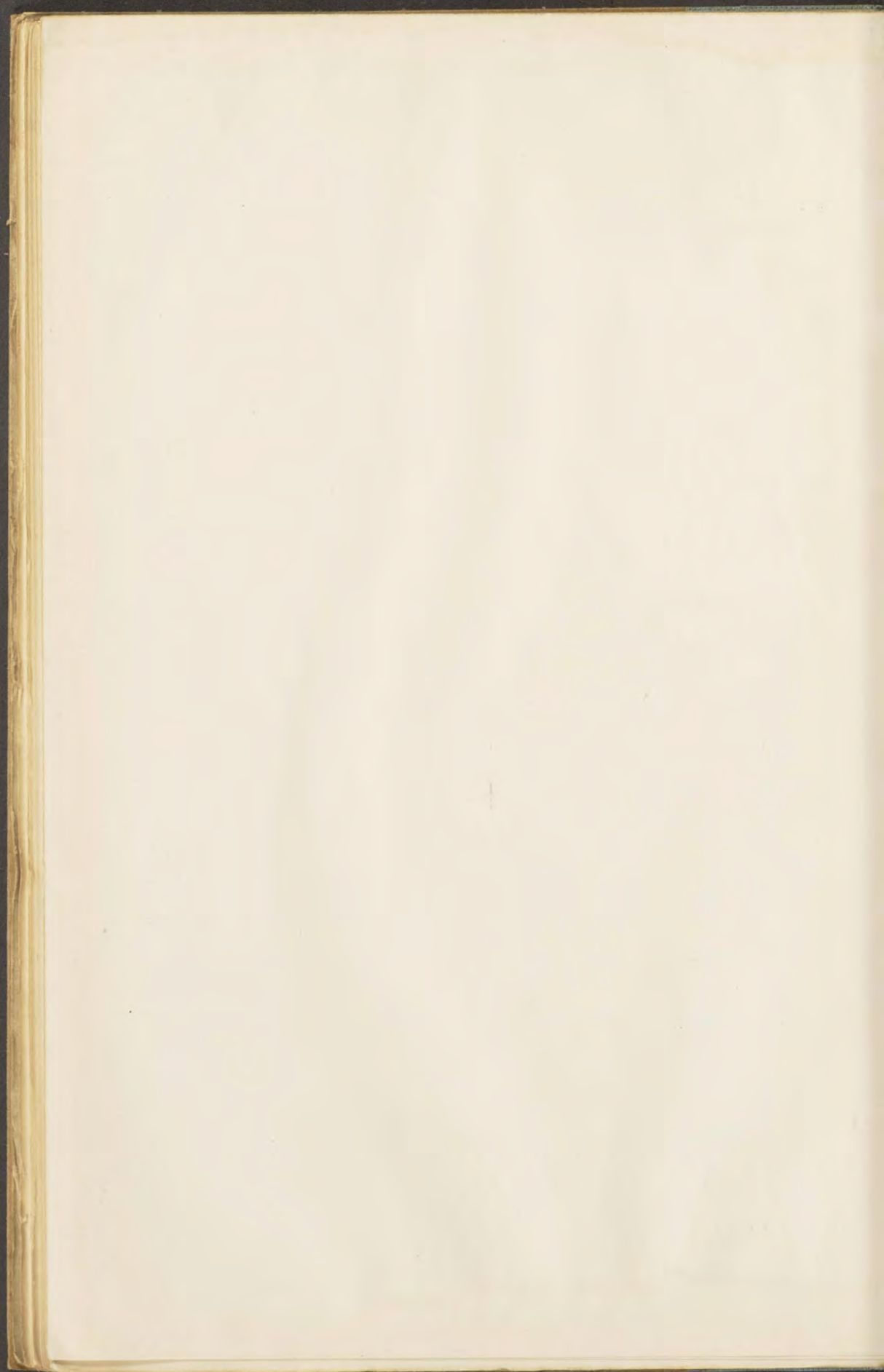
40. Ngawi.....	42.77	0.78	24.06	15.31	2.63	2.73	0.45	2.87	0.65	tr	Fe S 5.71	.....	Chromite 0.47 Ni O 1.57 Mn O tr	100.00	...	or 2.2 ns 4.0 cm 0.5 ab 2.1 di 10.6 tr 5.7 hy 43.2 nf 3.5 ol 27.2	Ccn	E. H. von Baumhauer.....	Arch. Neerland, 1884, 19, 175-185
41. Middlesborough...	42.61	1.75	23.80	20.86	1.60	.....	.....	7.22	2.00	0.16	.....	.....	.....	100.00	...	an 4.7 di 2.8 nf 9.4 hy 52.2 ol 31.0	Cw	W. Flight.....	Phil. Trans. Roy. Soc. 1882, 3, 885-899. Mass anal. calc. by Farrington

## PERFEMIC, PERSILICIC, PERPOLIC, PYROLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, TRAVISOSE

42. Hendersonville....	46.06	2.20	14.33	28.62	2.13	0.96	0.10	2.37	0.21	0.01	1.61	0.01	Cr <sub>2</sub> O <sub>3</sub> 0.23 Residue 0.51	99.35	...	or 0.6 di 7.3 cm 0.2 ab 8.4 hy 36.5 tr 4.4 an 1.4 ol 36.5 nf 2.6	Cc	Wirt Tassin....	Proc. U. S. Nat. Mus. 1907, 32, 79-82
43. Travis County....	44.75	2.72	16.04	27.93	2.23	1.13	0.13	1.83	0.22	0.01	1.83	.....	Cr <sub>2</sub> O <sub>3</sub> 0.52 H <sub>2</sub> O 0.84 Mn O tr P <sub>2</sub> O <sub>5</sub> 0.41 Cu O tr	101.11	3.54	or 0.6 di 5.1 cm 0.7 ab 9.4 hy 30.0 tr 5.0 an 2.0 ol 44.0 ap 0.9 nf 2.1	Cs	L. G. Eakins....	Bull. U. S. Geol. Survey 1891, 78, 91
44. Ergheo.....	42.53	2.23	17.13	26.13	1.08	0.13	0.57	0.17	.....	.....	Fe S 9.48	.....	.....	99.45	3.31	ab 1.1 hy 45.9 tr 9.5 an 5.6 ol 36.8 nf 0.7	Ckb	G. Boeris.....	Soc. d'Esploraz. Comm. in Africa, Milan 1898, 13
45. Mauerkirchen.....	41.53	1.71	23.32	24.20	2.12	0.24	0.15	3.75	.....	.....	0.70	.....	.....	98.44	...	or 0.6 di 5.9 cm 0.7 ab 2.1 hy 32.3 tr 1.9 an 3.3 ol 47.4 nf 3.8	Cw	F. Crook.....	Chem. Const. Met. Stones, 26-30
46. New Concord.....	40.39	2.30	18.13	23.51	2.52	.....	.....	5.78	0.24	.....	.....	.....	Fe <sub>2</sub> O <sub>3</sub> 5.82 Ni O 0.81 Mn tr	99.50	...	an 6.4 di 4.0 ml 8.4 hy 40.6 nf 6.0 ol 33.2	Cia	A. Madelung....	Buchner's Meteoriten 1863, 105
47. Sokobanja.....	40.14	.....	25.54	25.78	.....	0.26	0.06	.....	.....	.....	1.46	tr	.....	100.21	...	ks 0.2 tr 4.1 ns 0.5 nf 6.8 hy 41.3 ol 46.6	Cc	S. M. Losanitch	Ber. Chem. Gesell. Berlin 1878, 11, 96-98. Mass anal. calc. by Wadsworth
48. Manbhoom.....	40.12	1.80	20.53	27.30	1.93	0.44	0.20	4.24	0.91	.....	1.70	0.20	Fe <sub>2</sub> O <sub>3</sub> 0.83 Cr <sub>2</sub> O <sub>3</sub> 0.55 Mn O 0.07	100.82	...	or 1.1 di 5.6 ml 1.2 ab 3.7 hy 24.8 cm 0.9 an 2.5 ol 48.9 tr 4.7 sc 1.2 nf 5.2	Bu	H. B. von Foullon	Ann. Wien. Mus. 1888, 3, 195-208
49. Long Island.....	35.65	3.08	22.85	22.74	1.40	0.25	0.03	2.60	0.67	0.04	1.90	0.06	Cr <sub>2</sub> O <sub>3</sub> 6.33 H <sub>2</sub> O 1.52 Ni O 0.77 Co O 0.06 Mn O tr	99.95	3.45	ab 2.1 hy 27.3 cm 9.4 an 7.0 ol 42.3 tr 5.2 C 0.1 sc 0.4 nf 3.3	Cia	H. W. Nichols...	Pubs. Field Col. Mus. Geol. Ser. 1902, 1, 297

## PERFEMIC, PERSILICIC, PERPOLIC, PYROLIC, PERMIRLIC, PERMIRIC, MAGNESIFERROUS, CONCORDOSE

50. New Concord.....	41.73	0.28	24.72	21.64	0.02	0.92	9.23	1.31	0.04	0.11	tr	.....	Cu tr Mn tr	100.00	3.55	ab 1.6 ns 1.5 tr 0.3 hy 50.4 nf 10.6 ol 35.6	Cia	J. L. Smith.....	Am. Jour. Sci. 1861, 2, 31, 87-98. Mass anal. calc. by Farrington
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## ANALYSES OF STONE METEORITES—Continued

## PERFEMIC, PERSILICIC, PERPOLIC, DOMOLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, WACONDOSE

Name	Si O <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe O	Mg O	Ca O	Na <sub>2</sub> O	K <sub>2</sub> O	Fe	Ni	Co	S	P	Miscellaneous	Sum	Sp. gr.	Norm	Brezina's Symbol	Analyst	Reference
51. Zavid.....	41.90	1.92	27.40	22.79	4.60	1.05	0.41	0.15	....	....	1.01	....	H <sub>2</sub> O 0.39	101.11	3.55	or 2.2 ns 0.2 tr 2.7 ab 7.9 di 18.7 nf 0.2 ol 68.7	Cia	C. Hödlmoser...	Wiss. Mitth. Bosnia u. Herzegovina, 1901, 8, 419
52. Nowo-Urei.....	39.51	0.60	13.35	35.80	1.40	....	....	5.25	0.20	....	0.15	0.02	Cr <sub>2</sub> O <sub>3</sub> 0.05 Mn O 0.43 Carbon 1.26 Diamond 1.00	99.92	...	an 1.7 di 4.2 cm 1.3 hy 16.7 tr 0.4 ol 67.2 nf 5.5	U	M. Jerofejoff and P. Latschinoff	Verh. d. Russ. Kais. Miner. Ges. 1888, 24, 34 pp.
53. Cynthiana.....	38.99	0.22	19.73	26.56	2.20	0.49	....	5.36	0.50	0.07	Fe S 5.50	....	Cr <sub>2</sub> O <sub>3</sub> 0.15	99.77	3.41	ab 1.1 ns 0.7 cm 0.2 di 8.8 tr 5.5 hy 23.0 nf 5.9 ol 54.6	Cg	J. L. Smith.....	Am. Jour. Sci. 1877, 3, 14, 226. Mass anal. calc. by Wadsworth
54. Waconda.....	38.14	1.02	23.44	26.69	tr	1.05	tr	4.64	0.65	0.05	Fe S 3.85	tr	Mn O 0.47 Li <sub>2</sub> O tr Cu tr	100.00	3.50	ab 5.2 ns 1.1 tr 3.9 hy 14.9 nf 5.3 ol 69.7	Ccb	J. L. Smith.....	Am. Jour. Sci. 1877, 3, 13, 212. Mass anal. calc. by Farrington
55. Bluff.....	37.70	2.17	23.82	25.94	2.20	....	....	4.41	0.88	0.37	1.30	....	Ni O 1.50 P <sub>2</sub> O <sub>5</sub> 0.25 Co O 0.16 Mn O 0.45	101.24	3.51	an 6.1 di 2.5 ap 0.7 hy 19.4 tr 3.6 ol 63.0 nf 5.7	Ck	J. E. Whitfield...	Am. Jour. Sci. 1888, 3, 36, 119

## PERFEMIC, PERSILICIC, PERPOLIC, DOMOLIC, PERMIRLIC, PERMIRIC, MAGNESIFERROUS, KABOSE

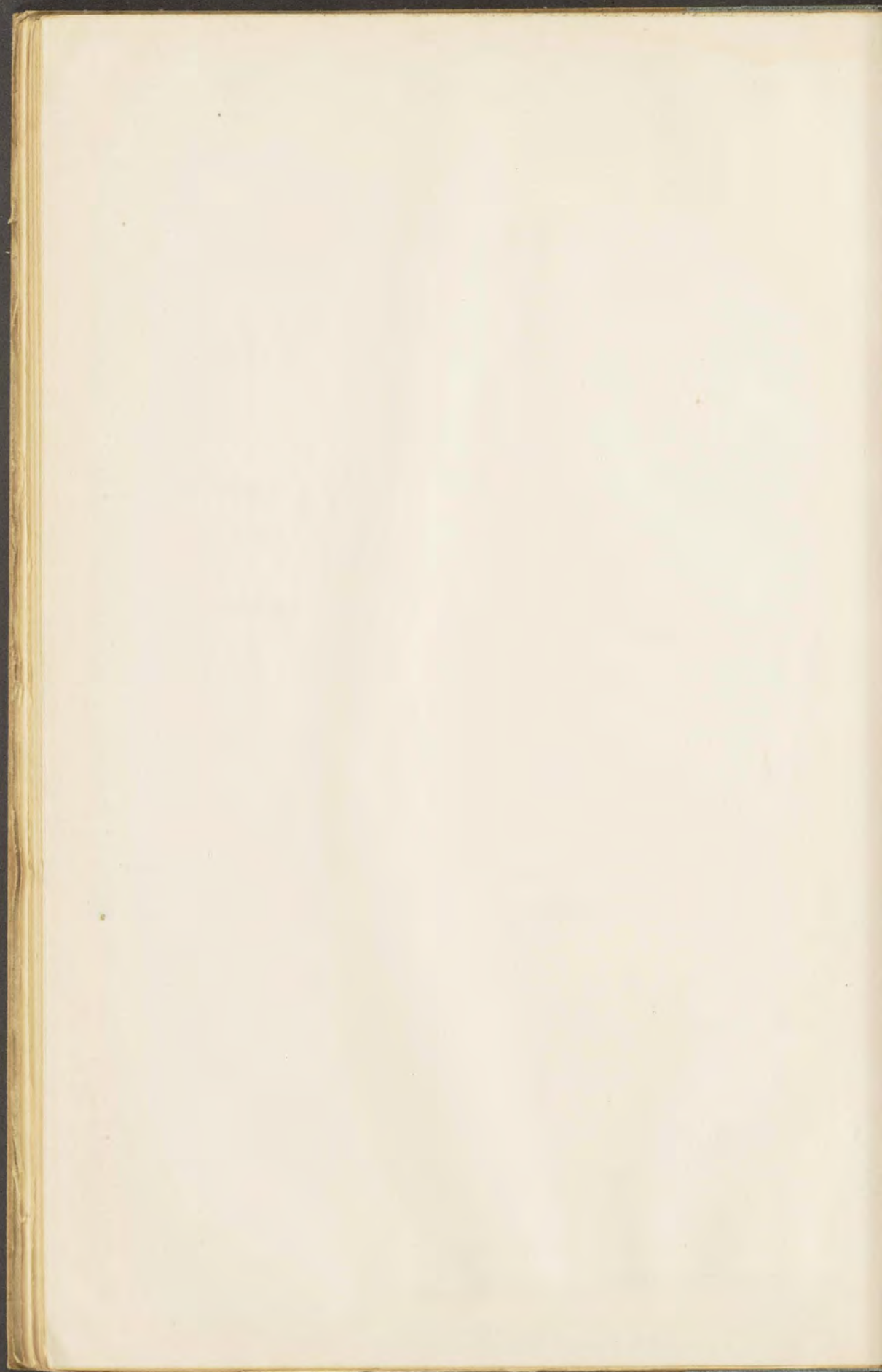
56. Chateau Renard...	38.13	3.82	29.44	17.67	0.14	0.86	0.27	7.70	1.55	....	0.39	....	Chromite 0.89 Mn O 0.05 Cu 0.01 C 0.58	99.97	3.56	or 1.7 hy 24.9 tr 1.1 ab 7.3 di 52.9 nf 9.3 an 0.8 C 1.7	Cia	A. Dufrenoy.....	Comptes Rendus, 1841, 13, 47-53
57. Kaba.....	34.24	5.38	26.20	22.39	0.66	....	0.30	2.88	1.37	tr	Fe S 3.55	tr	Chromite 0.89 Mn O 0.05 Cu 0.01 C 0.58	98.50	...	or 1.7 hy 15.0 cm 0.0 an 3.3 di 65.4 tr 3.6 C 3.9 ol 76.0 nf 4.3	K	F. Wohler.....	Sitzber. Wien. Akad. 1858, 33, 205-209

## PERFEMIC, PERSILICIC, PERPOLIC, PEROLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, KAKOVOSE

58. Kakova.....	37.97	2.27	22.68	24.98	0.69	1.77	0.52	7.15	1.24	0.09	....	0.01	Chromite 0.07 Mn O 0.42 Graphite 0.14	100.00	3.38	or 2.8 ns 1.2 cm 0.1 ab 9.4 di 0.8 nf 8.5 an 1.7 ol 76.0 am 0.9	Cga	E. P. Harris.....	Chem. Const. Met. 1859, 22-34. Mass anal. calc. by Farrington
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## PERFEMIC, PERSILICIC, PERPOLIC, PEROLIC, PERMIRLIC, PERMIRIC, MAGNESIFERROUS, JEROMOSE

59. Warrenton.....	35.51	0.13	30.17	25.57	1.43	0.23	....	1.79	0.21	....	Fe S 3.51	....	Cr <sub>2</sub> O <sub>3</sub> 0.06 Ni O 1.16 Co O 0.23	100.00	3.47	ab 0.5 ns 0.2 cm 0.2 di 5.7 tr 3.5 hy 1.0 nf 2.0 ol 85.4	Cco	J. L. Smith.....	Am. Jour. Sci. 1877, 3, 14, 223. Mass anal. calc. by Farrington
60. Felix.....	33.57	3.24	26.22	19.74	5.45	0.62	0.14	2.59	0.36	0.08	Fe S 4.76	....	Cr <sub>2</sub> O <sub>3</sub> 0.80 H <sub>2</sub> O 0.16 Ni O 1.01 Cu O 0.01 Mn O 0.68 Graphite 0.36	99.79	3.78	lc 0.4 di 0.2 cm 1.1 ne 2.8 ol 73.4 tr 4.8 an 5.6 am 7.7 nf 3.0	Kc	Peter Fireman...	Proc. U. S. Nat. Mus. 1901, 24, 193-198
61. Jerome.....	33.11	1.77	27.97	21.59	1.31	0.65	0.28	3.81	0.43	0.01	1.88	....	Cr <sub>2</sub> O <sub>3</sub> 0.58 P <sub>2</sub> O <sub>5</sub> 0.37 Ni O 1.77 H <sub>2</sub> O 3.03	98.56	3.47	or 1.7 di 2.3 cm 0.0 ab 5.8 ol 72.7 ap 1.0 an 1.1 tr 5.1 nf 4.3	Cck	H. S. Washington	Am. Jour. Sci. 1898, 4, 5, 453





## ANALYSES OF STONE METEORITES—Continued

## PERFEMIC, PERSILICIC, DOPOLIC, PYROLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, ELWAHOSE

Name	Si O <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe O	Mg O	Ca O	Na <sub>2</sub> O	K <sub>2</sub> O	Fe	Ni	Co	S	P	Miscellaneous	Sum	Sp. gr.	Norm	Brezina's Symbol	Analyst	Reference
62. Eli Elwah.....	39.47	2.87	17.06	25.58	1.61	0.73	0.11	....	1.01	....	2.30	0.10	Fe <sub>2</sub> O <sub>3</sub> 9.18	100.02	...	<i>or</i> 0.6 <i>di</i> 2.9 <i>ml</i> 13.5 <i>ab</i> 5.8 <i>hy</i> 31.6 <i>tr</i> 6.3 <i>an</i> 4.4 <i>ol</i> 29.1 <i>sc</i> 0.6 <i>nf</i> 1.0	C	A. Liversidge.....	Proc. Roy. Soc. New South Wales, 1903, 341-359

## PERFEMIC, DOSILICIC, PERPOLIC, PERPYRIC, PERMIRLIC, PERMIRIC, PERMAGNESIC, HVITTISOSE

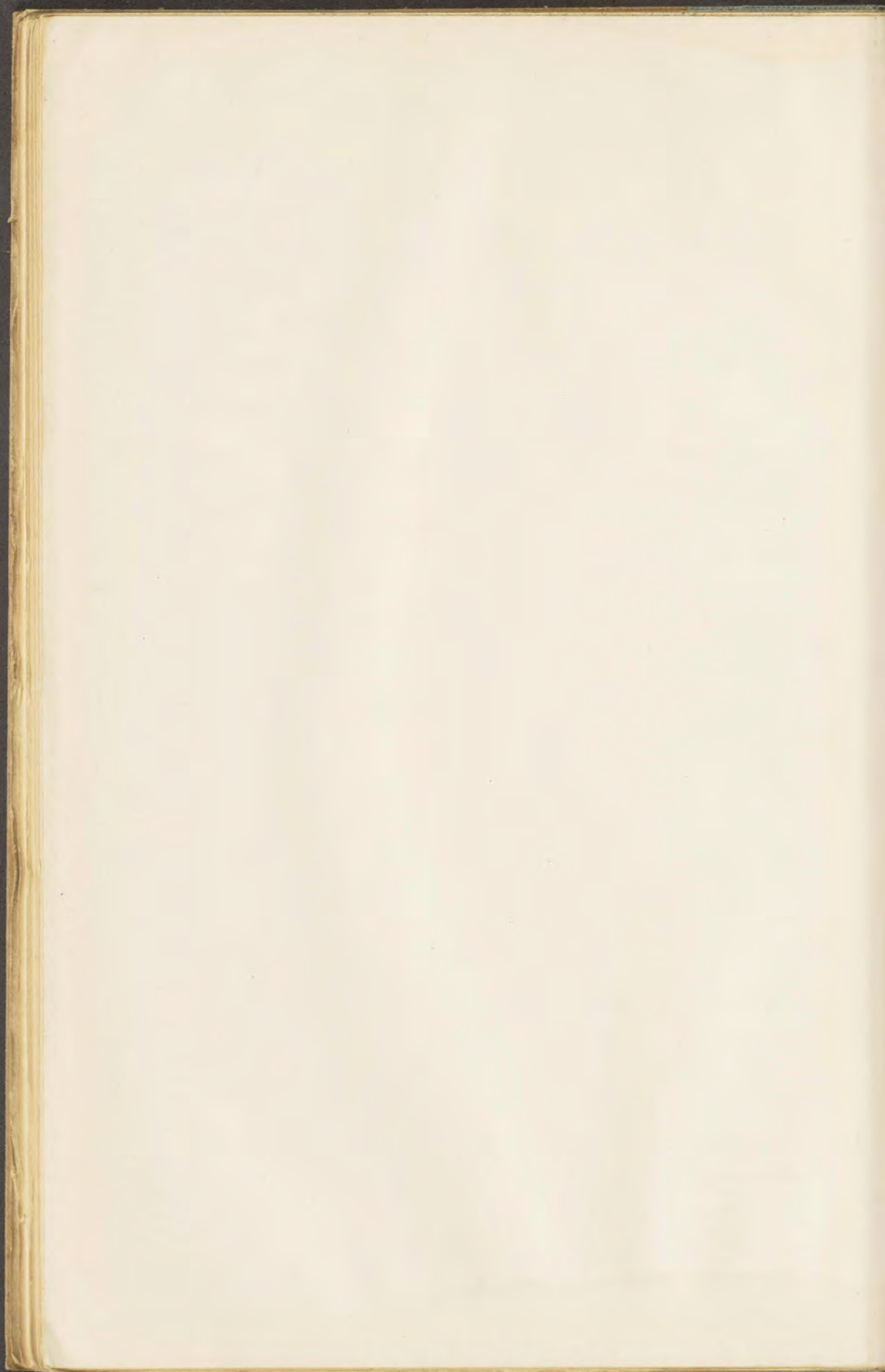
63. Bremervörde.....	45.40	2.34	4.36	22.40	....	1.18	0.37	21.61	1.89	....	....	....	Chromite 0.31 Graphite 0.14	100.00	3.54	<i>or</i> 2.2 <i>hy</i> 63.7 <i>cm</i> 0.3 <i>ab</i> 10.0 <i>ol</i> 0.3 <i>nf</i> 23.5	Ccb	F. Wohler.....	Ann. Chem. Pharm. 1856, 99, 244-248
64. Hvittis.....	41.53	1.55	0.34	23.23	1.41	1.26	0.32	24.66	1.96	0.07	3.30	0.08	Cr <sub>2</sub> O <sub>3</sub> 0.34	100.28	...	<i>or</i> 1.7 <i>ns</i> 0.9 <i>cm</i> 0.9 <i>ab</i> 6.8 <i>di</i> 5.4 <i>tr</i> 9.1 <i>hy</i> 52.2 <i>sc</i> 0.6 <i>ol</i> 2.4 <i>nf</i> 20.4	Cek	L. H. Borgström	Die Meteoriten von Hvittis u. Marjalahiti, Helsingfors 1903, 24

## PERFEMIC, DOSILICIC, PERPOLIC, PERPYRIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, MOCSOSE

65. Mocs.....	42.74	tr	20.86	15.95	2.78	1.20	0.21	7.93	1.38	tr	2.61	0.41	Chromite 1.56 Mn 0.57 Mn O 1.12 Li <sub>2</sub> O tr C 0.19	99.51	3.64	<i>Q</i> 3.5 <i>ks</i> 0.3 <i>cm</i> 1.6 <i>ns</i> 2.3 <i>tr</i> 7.1 <i>di</i> 11.3 <i>sc</i> 2.6 <i>hy</i> 58.8 <i>nf</i> 9.9	Cwa	F. Koch.....	Min. Mitth. 1883, 2, 5, 243
66. St. Mark's.....	38.29	0.64	6.50	18.23	1.08	0.85	0.23	26.44	1.84	0.21	5.26	0.05	Mn O 0.33 Cl 0.27 Mn 0.29 C 0.36 Ca 0.28	101.15	...	<i>Q</i> 1.3 <i>ns</i> 1.2 <i>tr</i> 14.2 <i>or</i> 1.1 <i>di</i> 4.5 <i>sc</i> 0.4 <i>ab</i> 2.1 <i>hy</i> 56.0 <i>oh</i> 0.2 <i>nf</i> 19.4	Ck	E. Cohen.....	Ann. South African Mus. 1906, 5, 1-16

## PERFEMIC, DOSILICIC, PERPOLIC, DOPYRIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, CASTALIOSE

67. Modoc.....	44.13	2.47	15.37	26.45	1.74	0.44	tr	6.56	0.68	0.03	1.38	0.05	Mn O 0.10	99.40	3.54	<i>ab</i> 3.7 <i>di</i> 2.9 <i>tr</i> 3.8 <i>an</i> 5.0 <i>hy</i> 47.4 <i>sc</i> 0.2 <i>ol</i> 28.4 <i>nf</i> 7.3	Cwa	Wirt Tassin.....	Am. Jour. Sci. 1906, 4, 21, 359
68. Krähenberg.....	41.78	0.06	19.53	24.44	1.94	1.00	....	6.31	0.54	....	2.17	....	Chromite 0. Mn O tr	98.68	3.50	<i>ab</i> 0.5 <i>ns</i> 1.8 <i>tr</i> 6.1 <i>di</i> 7.6 <i>nf</i> 6.9 <i>hy</i> 47.0 <i>ol</i> 26.8	Cho	G. von Rath.....	Ann. Phys. Chem. 1869, 137, 328-336. Mass anal. calc. by Wadsworth
69. Bachmut.....	39.59	2.71	18.81	23.37	0.04	0.63	tr	8.52	1.24	....	2.37	0.05	Chromite 0.79 Mn O 0.04 Mn 0.21	98.37	3.56	<i>ab</i> 5.2 <i>hy</i> 46.2 <i>cm</i> 0.8 <i>C</i> 1.6 <i>ol</i> 26.6 <i>tr</i> 6.5 <i>nf</i> 10.0	Cw	A. Kuhlberg.....	Archiv. Nat. Liv. Ehst. Kurlands 1867, 1, 4, 132
70. Drake Creek.....	38.50	4.81	10.03	22.79	0.70	0.59	0.02	12.82	1.50	0.16	1.80	....	Cr <sub>2</sub> O <sub>3</sub> 1.37 Ni O, Cu O, Sn O <sub>2</sub> 2.53 Cu + Sn 0.07	100.00	...	<i>ab</i> 5.2 <i>hy</i> 43.1 <i>cm</i> 2.0 <i>an</i> 3.6 <i>ol</i> 23.6 <i>tr</i> 4.9 <i>C</i> 2.5 <i>nf</i> 14.6	Cwa	E. H. Baumhauer	Ann. Phys. Chem. 1845, 66, 498-503
71. Castalia.....	38.50	2.14	13.31	29.83	....	0.55	tr	14.19	0.96	0.06	0.46	tr	Li <sub>2</sub> O tr	100.00	...	<i>ab</i> 4.7 <i>hy</i> 27.5 <i>tr</i> 1.2 <i>C</i> 1.2 <i>ol</i> 49.9 <i>nf</i> 15.2	Cgb	J. L. Smith.....	Am. Jour. Sci. 1875, 3, 10, 147-148
72. Dundrum.....	37.80	0.85	7.92	23.33	1.32	0.96	0.50	19.57	1.03	....	4.05	....	Chromite 1.50 Mn O 0.16	98.99	3.32	<i>or</i> 0.6 <i>ns</i> 1.0 <i>cm</i> 1.5 <i>ab</i> 4.2 <i>di</i> 5.1 <i>tr</i> 4.1 <i>hy</i> 20.8 <i>nf</i> 20.6 <i>ol</i> 21.4	Ck	S. Haughton.....	Proc. Roy. Soc. 1866, 15, 214-217. Mass anal. calc. by Wadsworth
73. Gopalpur.....	37.44	2.52	11.94	19.72	1.60	0.62	0.21	20.96	1.80	0.10	1.74	....	Cr <sub>2</sub> O <sub>3</sub> tr Mn O 0.26	98.91	...	<i>or</i> 1.1 <i>di</i> 3.6 <i>tr</i> 4.8 <i>ab</i> 5.2 <i>hy</i> 41.9 <i>nf</i> 22.9 <i>an</i> 3.6 <i>ol</i> 15.1	Cc	A. Exner.....	Min. Mitth. 1872, 41-43





## ANALYSES OF STONE METEORITES—Continued

## PERFEMIC, DOSILICIC, PERPOLIC, DOPYRIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, CASTALIOSE—Continued

Name	Si O <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe O	Mg O	Ca O	Na <sub>2</sub> O	K <sub>2</sub> O	Fe	Ni	Co	S	P	Miscellaneous	Sum	Sp.gr.	Norm	Brezina's Symbol	Analyst	Reference
74. Adare.....	37.26	2.03	8.95	13.50	3.61	0.79	0.12	16.24	2.73	0.10	Fe S 6.54	....	Chromite 1.75 Mn O 5.50 V tr	99.12	3.93	or 0.6 di 13.2 cm 1.8 ab 6.8 hy 37.7 tr 6.5 an 1.7 ol 11.8 nf 19.1	Cga	R. Apjohn.....	Jour. Chem. Soc. 1874, 2, 12, 104-106. Mass anal. calc. by Wads- worth
75. Tokeuchimura.....	36.34	....	14.76	20.91	2.47	1.18	0.28	16.58	1.82	0.05	2.75	0.08	Fe <sub>2</sub> O <sub>3</sub> 0.36 Mn O 0.16 Cr O 0.42 Ni O 0.30 Chromite 0.95	99.40	3.81	ks 0.5 mt 0.7 ns 2.3 cm 1.6 di 9.8 tr 7.6 hy 42.5 sc 0.6 ol 14.0 nf 18.5	Ck	Lindner.....	Ber. Berlin Akad. 1904, 978-983
76. Stålldalen.....	35.71	2.11	10.29	23.16	1.61	0.62	0.15	21.10	1.61	0.17	2.27	0.01	Cr <sub>2</sub> O <sub>3</sub> 0.40 P <sub>2</sub> O <sub>5</sub> 0.30 Ni O 0.20 Cl 0.04 Mn O 0.25	100.00	3.74	or 0.6 hy 41.3 cm 0.7 ab 5.2 ol 20.3 ap 0.7 an 1.1 tr 6.3 C 1.0 nf 22.9	Cga	G. Lindström....	Öfversigt. Kongl. Vetén. Forhan. 1877, 35
77. Gnadenfrei.....	32.11	1.60	14.88	17.03	2.01	0.70	....	25.16	3.92	tr	1.87	....	Cr <sub>2</sub> O <sub>3</sub> 0.57 Mn O tr P <sub>2</sub> O <sub>5</sub> tr	99.85	3.71	ab 5.8 di 7.0 cm 0.9 an 1.4 hy 27.5 tr 5.1 ol 22.4 nf 29.1	Cc	Galle and Lasaulx.....	Monatsber. Berlin Akad. 1879, 750-771
78. Orgueil.....	26.08	0.90	15.77	17.00	1.85	2.26	0.19	....	....	....	Fe S 13.43	....	Fe <sub>2</sub> O <sub>3</sub> 7.78 Chromite 0.49 Mn O 0.36 H <sub>2</sub> O and org. matter 13.89	100.00	2.50	or 1.1 ns 3.5 mt 11.4 ab 3.7 di 7.5 cm 0.5 an 4.2 ol 27.2 nf 13.4 ol 44.6	K	Pisani.....	Comptes Rendus 1864, 59, 134

## PERFEMIC, DOSILICIC, PERPOLIC, DOPYRIC, PERMIRLIC, PERMIRIC, MAGNESIFERROUS, ENSISHEIMOSE

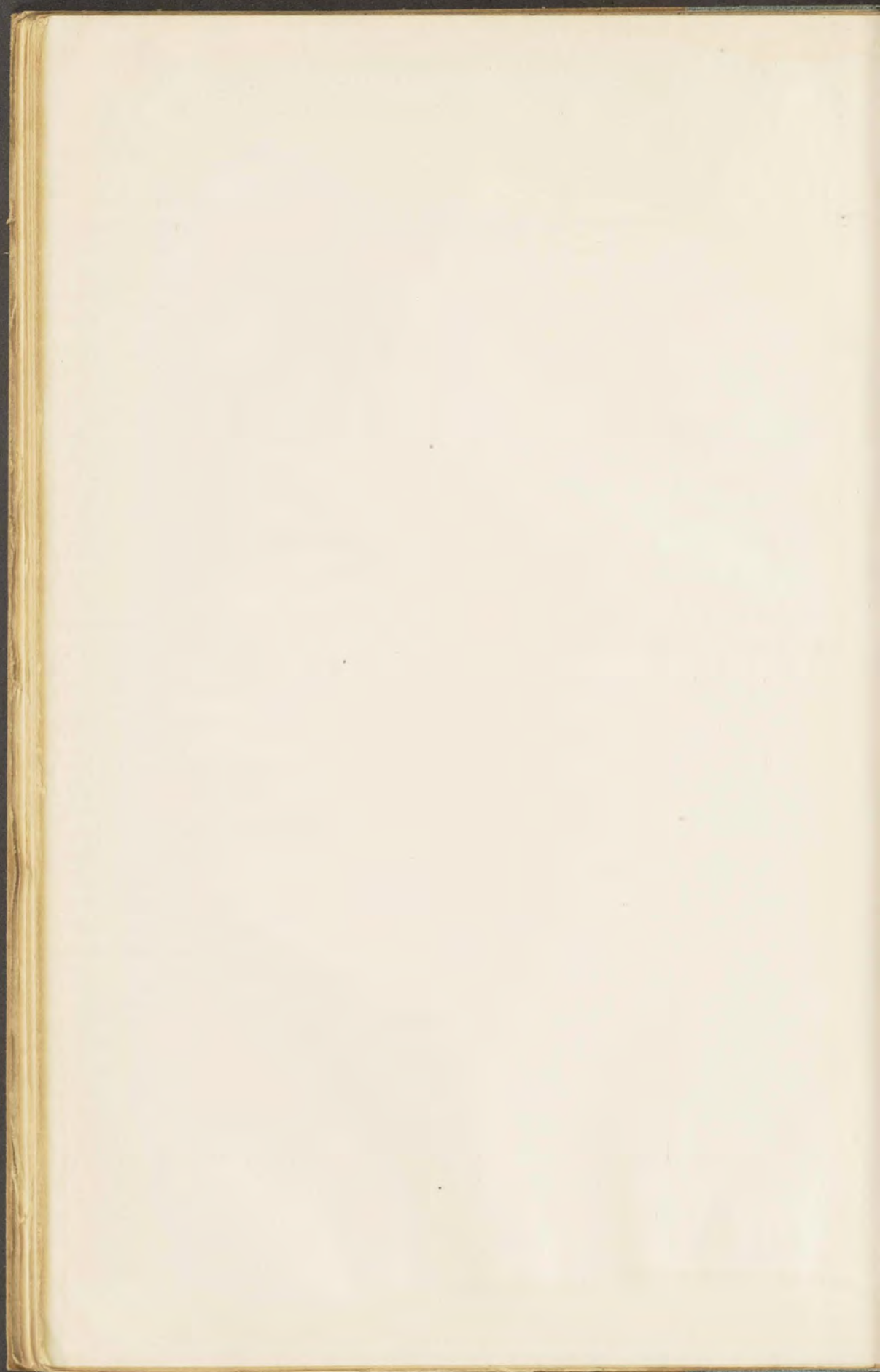
79. Ensisheim.....	35.65	2.31	34.19	13.13	1.78	0.38	0.22	8.00	1.23	....	2.05	1.01	Cr <sub>2</sub> O <sub>3</sub> 0.41 Mn O 0.21	99.57	3.50	or 1.1 di 3.0 cm 0.7 ab 3.1 hy 38.8 tr 5.6 an 4.2 ol 25.2 nf 9.2	Ckb	F. Crook.....	Chem. Const. Met. Stones, 21-26
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## PERFEMIC, DOSILICIC, PERPOLIC, PYROLIC, PERMIRLIC, PERMIRIC, PERMAGNESIC, ORVINIOSE

80. Orvinio.....	37.42	2.27	7.98	22.90	2.32	1.21	0.29	22.23	2.60	....	1.99	....	....	101.19	3.64	or 1.7 di 8.7 tr 5.5 ab 10.0 hy 24.6 nf 24.8 an 0.3 ol 24.7	Co	L. Sipöcz.....	Sitzber. Wien Akad. 1875, 52, 1, 464
81. Klein-Wenden.....	33.03	3.75	6.90	23.64	2.83	0.28	0.38	23.90	2.37	....	2.09	0.02	Cr <sub>2</sub> O <sub>3</sub> 0.62 Mn O 0.07 Sn 0.08	100.01	3.70	or 2.2 di 4.8 cm 0.9 ab 2.1 hy 20.0 tr 5.8 an 8.1 ol 27.8 nf 20.4	Ck	C. Rammelsberg	Ann. Phys. Chem. 1844, 62, 449-464

## PERFEMIC, DOSILICIC, PERPOLIC, PYROLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, PULTUSKOSE

82. Pultusk.....	41.54	1.17	14.04	26.73	0.28	1.34	....	11.51	0.65	....	0.87	tr	Chromite 0.29 Mn O 0.49 Insol. 0.04	99.01	3.66	ab 6.3 ns 1.2 cm 0.3 di 1.1 tr 2.4 hy 38.6 nf 12.2 ol 36.5	Cga	G. von Rath....	Neues Jahrb. Min. 1869, 80-82. Mass anal. calc. by Wads- worth
83. Searsmont.....	40.82	0.81	13.84	25.99	....	0.85	....	13.24	1.33	0.06	Fe S 3.06	....	Chromite tr Li <sub>2</sub> O tr	100.00	3.7c	ab .2 ns 0.7 tr 3.1 hy 44.0 nf 14.6 ol 33.4	Cc	J. L. Smith.....	Am. Jour. Sci. 1871, 3, 2, 200. Mass anal. calc. by Farrington
84. Rochester.....	40.77	0.10	16.52	26.47	2.43	0.58	....	9.52	0.42	0.05	Fe S 2.99	....	Chromite 0.15	100.00	3.55	ab 0.5 ns 1.0 cm 0.2 di 9.6 tr 3.0 hy 33.6 nf 10.0 ol 42.1	Cc	J. L. Smith.....	Am. Jour. Sci. 1877, 3, 14, 222. Mass anal. calc. by Farrington

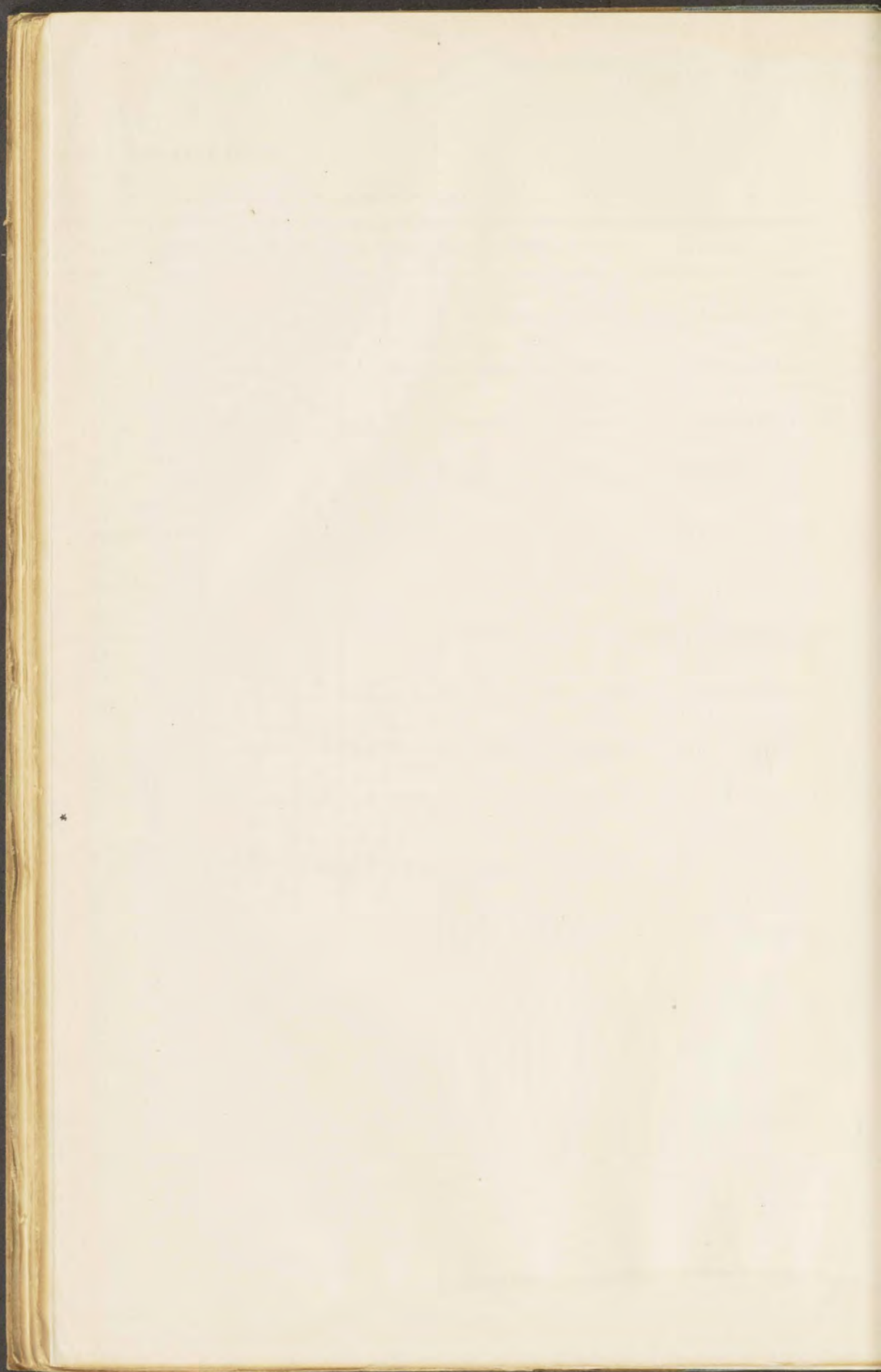




## ANALYSES OF STONE METEORITES—Continued

PERFEMIC, DOSILICIC, PERPOLIC, PYROLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, PULTUSKOSE—Continued

Name	Si O <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe O	Mg O	Ca O	Na <sub>2</sub> O	K <sub>2</sub> O	Fe	Ni	Co	S	P	Miscellaneous	Sum	Sp. gr.	Norm	Brezina's Symbol	Analyst	Reference
85. Dhurmsala.....	40.69	0.60	11.20	26.59	....	0.39	0.21	6.88	1.54	....	Fe S 5.61	....	Chromite 4.16 Mn O 1.26	99.13	3.40	or 1.1 ns 0.2 cm 4.2 ab 2.1 hy 46.9 tr 5.6 ol 30.4 nf 8.4	Ci	S. Haughton....	Proc. Roy. Soc. 1866, 15, 214-217. Mass anal. calc. by Wads- worth
86. Richmond.....	40.37	2.21	13.82	28.33	2.68	....	....	8.22	....	....	Fe S 4.37	....	....	100.00	3.37	an 6.1 di 5.6 tr 4.4 hy 30.2 nf 8.2 ol 45.5	Cck	C. Rammelsberg.	Monatsber. Berlin Akad. 1870, 70, 440
87. Tieschitz.....	40.23	1.93	19.80	20.55	1.54	1.53	....	10.26	1.31	....	1.65	....	....	98.80	3.59	ab 9.9 ns 0.6 tr 4.5 di 6.3 nf 11.6 hy 30.9 ol 34.1	Cc	J. Habermann...	Denkschr. Wien Akad. 1879, 39, 187-201
88. St. Denis-Westrem	40.20	2.54	16.22	25.08	2.00	0.99	tr	10.37	1.24	0.12	2.12	....	Cr <sub>2</sub> O <sub>3</sub> 0.90 Mn O tr	101.78	...	ab 8.4 di 6.0 cm 1.4 an 2.5 hy 26.7 tr 5.8 ol 38.3 nf 11.7	Cca	C. Klement.....	Bull. Mus. roy. d'hist. Nat. Belgique 1886, 4, 280
89. St. Christophe....	39.33	2.15	13.66	25.90	1.51	0.51	0.18	7.79	1.67	0.11	Fe S 6.90	....	Cr <sub>2</sub> O <sub>3</sub> 0.38	100.09	...	or 1.1 di 3.8 cm 0.0 ab 4.2 hy 27.9 tr 6.0 an 3.1 ol 42.8 nf 9.6	Cg	M. A. Lacroix....	Bull. Soc. de l'Onest de la France, 1906, 2, 6, 81-112
90. Tadjera.....	39.20	1.64	14.18	25.68	2.66	....	....	8.32	....	....	Fe S 8.04	....	Cr <sub>2</sub> O <sub>3</sub> 0.12	99.84	3.60	an 4.5 di 6.0 cm 0.2 hy 33.4 tr 8.0 ol 38.4 nf 8.3	Ct	S. Meunier.....	Comptes Rendus 1868, 66, 513-519
91. Shelburne.....	39.19	2.15	15.16	26.24	1.75	0.73	0.22	10.70	0.78	0.04	1.61	0.06	Cr <sub>2</sub> O <sub>3</sub> 0.62 Mn O 0.12	99.37	3.50	or 1.1 di 4.0 cm 0.0 ab 5.8 hy 25.5 tr 4.4 an 2.5 ol 41.6 sc 0.4 nf 11.5	Cg	L. H. Borgström.	Trans. Roy. Astr. Soc. of Canada 1904
92. Alfanello.....	39.14	0.93	17.42	25.01	1.96	0.75	0.10	11.31	1.09	....	2.71	....	....	100.42	...	or 0.6 ns 0.5 tr 7.4 ab 4.2 di 3.8 nf 12.4 hy 37.7 ol 31.5	Ci	H. von Foullon..	Sitzber. Wien Akad. 1883, 88, 1, 433
93. Marion.....	38.96	2.00	14.52	26.05	1.18	0.38	tr	13.51	1.08	....	2.32	....	....	100.00	...	ab 3.1 di 1.5 tr 6.3 an 3.9 hy 41.8 nf 14.6 ol 28.4	Cwa	C. Rammelsberg.	Monatsber. Berlin Akad. 1870, 457-459. Mass anal. calc. by Wadsworth
94. Aussun.....	38.72	1.85	16.93	22.53	0.80	0.57	0.11	8.63	0.96	....	Fe S 3.74	2.00	Chromite 1.83 Mn O tr	98.67	3.54	or 0.6 di 1.4 cm 1.8 ab 4.7 hy 35.2 tr 3.7 an 2.2 ol 37.3 sc 2.0 nf 9.6	Cc	H. A. Damour....	Comptes Rendus 1859, 49, 31-36
95. Beaver Creek.....	37.43	2.17	10.49	23.73	1.76	0.80	0.09	15.53	1.51	0.08	Fe S 5.05	....	Magnetite 0.16 H <sub>2</sub> O 0.20 Chromite 0.30 Ti O <sub>2</sub> 0.08 Ni O 0.03 Cu 0.01 Mn O 0.24 P <sub>2</sub> O <sub>5</sub> 0.25	100.00	...	or 0.6 di 4.5 cm 0.3 ab 6.8 hy 26.3 tr 0.2 an 2.2 ol 30.2 ap 0.3 nf 17.1	Cck	W. F. Hillebrand	Am. Jour. Sci. 1894, 3, 47, 430. Mass anal. calc. by Farrington
96. Saline.....	37.08	1.83	18.04	23.34	2.03	0.26	0.08	7.89	0.95	0.04	1.65	0.05	Fe <sub>2</sub> O <sub>3</sub> 4.45 H <sub>2</sub> O 1.23 Cr <sub>2</sub> O <sub>3</sub> 1.25 Ni O 0.74 Co O 0.07	100.99	3.62	or 0.6 di 5.3 mt 6.5 ab 2.1 hy 32.0 cm 2.0 an 3.6 ol 33.2 tr 4.5 sc 0.2 nf 8.9	Cck	H. W. Nichols and E. W. Tillotson	Private contribution
97. Hessle.....	36.83	2.38	10.85	23.21	1.80	0.94	....	20.08	2.15	0.02	1.88	0.15	Cr <sub>2</sub> O <sub>3</sub> 0.07 Mn O 0.42 Cu O 0.02 Cl 0.04	100.84	3.70	ab 7.0 di 5.1 tr 5.1 an 2.5 hy 28.8 tr 0.8 ol 27.3 nf 22.3	Cc	G. Lindstrom....	Kongl. Svenske. Vet. Ak. 1870
98. Ogi.....	36.75	1.89	8.84	23.36	1.94	0.97	0.16	15.35	1.75	....	Fe S 5.91	....	Chromite 0.61 Cu + Ni O 0.30 Sn 0.15 Mn O 0.51 Mn 0.18 P <sub>2</sub> O <sub>5</sub> 0.34	99.01	...	or 1.1 di 6.0 cm 0.6 ab 8.4 hy 22.7 ap 0.7 an 0.3 ol 35.0 tr 5.9 nf 17.4	Cw	T. Shimidzu....	Trans. Asiatic Soc. Japan 1882, 10, 199- 203
99. Lixna.....	36.45	2.52	13.16	25.08	tr	0.72	tr	16.95	1.71	....	2.13	0.14	Chromite 0.70 Mn O 0.03 Mn 0.43	100.02	3.73	ab 5.8 hy 39.0 cm 0.7 C 1.4 ol 26.7 tr 5.9 sc 0.8 nf 19.1	Cga	A. Kuhlberg....	Archiv. Nat. Liv. Ehst. Kurlands 1867, 1, 4, 1-32





## ANALYSES OF STONE METEORITES—Continued

## PERFEMIC, DOSILICIC, PERPOLIC, PYROLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, PULTUSKOSE — Continued

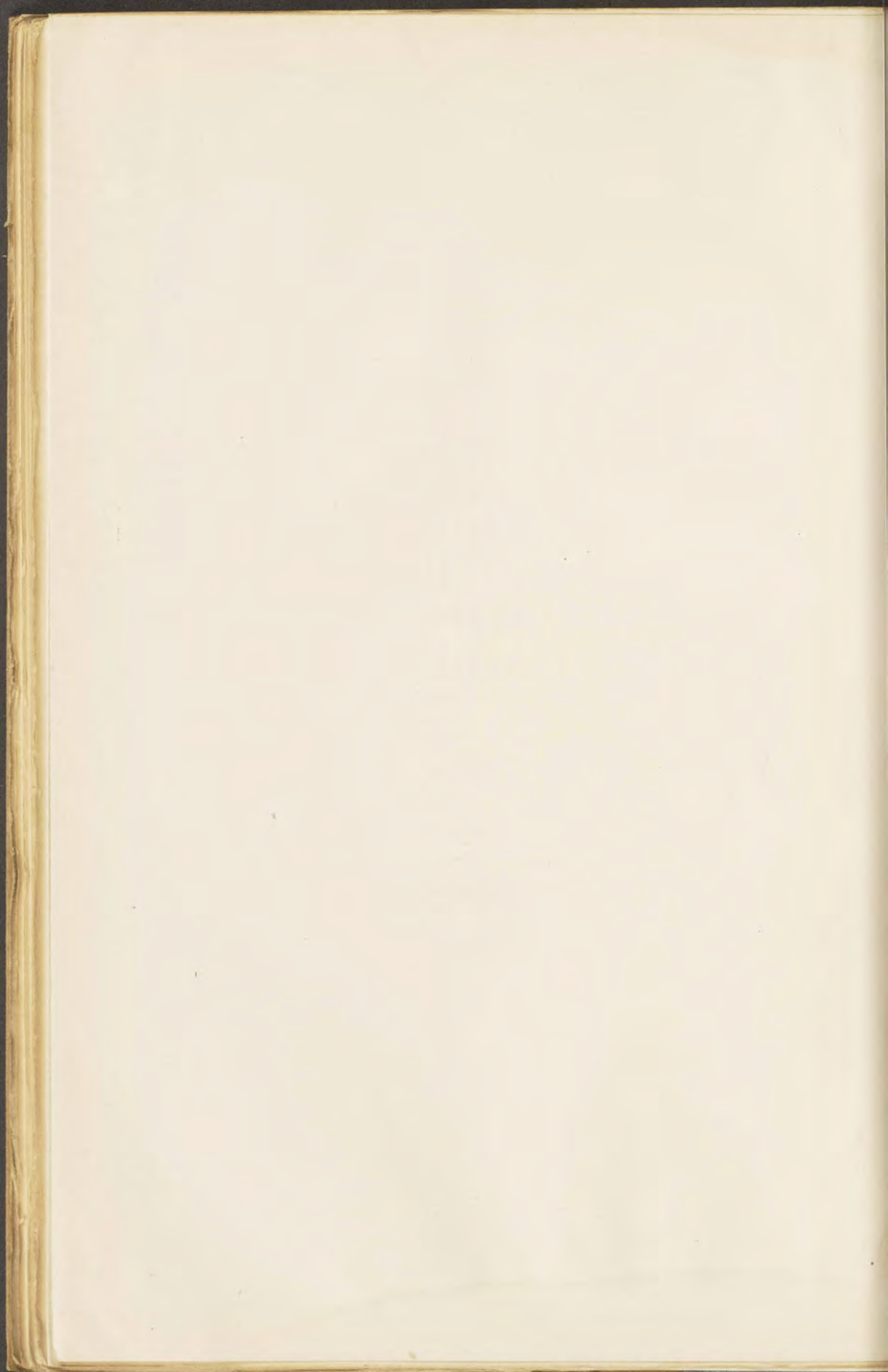
Name	Si O <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe O	Mg O	Ca O	Na <sub>2</sub> O	K <sub>2</sub> O	Fe	Ni	Co	S	P	Miscellaneous	Sum	Sp. gr.	Norm	Brezina's Symbol	Analyst	Reference
100. Salt Lake City...	36.05	1.96	11.70	23.02	1.87	0.85	0.06	15.67	1.38	0.10	Fe S 5.51	.....	Chromite 0.62 H <sub>2</sub> O 0.94 P <sub>2</sub> O <sub>5</sub> 0.26	100.00	3.66	or 0.6 di 4.9 cm 0.6 ab 7.3 hy 22.8 ap 0.7 an 1.4 ol 37.7 tr 5.5 nf 17.2		S. L. Penfield...	Am. Jour. Sci. 1886, 3, 32, 228
101. Pultusk.....	35.85	1.96	12.12	24.95	1.56	0.95	0.39	15.55	2.21	.....	.....	.....	Fe <sub>2</sub> O <sub>3</sub> 3.85	99.39	...	or 2.2 ns 1.1 m! 5.5 ab 3.1 di 6.2 nf 17.8 hy 21.7 ol 40.8	Cga	C. Rammelsberg.	Monatsber. Berlin Akad. 1870, 448-452. Mass anal. calc. by Wadsworth
102. Khetree.....	35.17	1.77	11.16	23.80	2.37	0.87	tr	18.79	1.26	0.21	1.76	0.12	Cr <sub>2</sub> O <sub>3</sub> 0.40 Cr 0.10	97.78	3.68	ab 7.3 di 8.4 cm 0.7 an 1.1 hy 20.2 tr 4.8 ol 33.2 sc 0.8 nf 20.4	Cgb	D. Waldie.....	Jour. Asiat. Soc. Ben- gal 1869, 38, 2, 252- 258
103. Allegan.....	34.95	2.55	8.47	21.99	1.73	0.66	0.23	21.09	1.81	0.15	Fe S 5.05	.....	Cr <sub>2</sub> O <sub>3</sub> 0.53 H <sub>2</sub> O 0.25 Ni O tr Ti O <sub>2</sub> 0.08 Mn O 0.18 Cu 0.01 Li <sub>2</sub> O tr P <sub>2</sub> O <sub>5</sub> 0.27	100.00	3.91	or 1.1 di 2.4 cm 0.7 ab 5.8 hy 27.7 tr 5.3 ol 29.8 ap 0.7 tr 5.1 nf 23.1	Cco	H. N. Stokes....	Proc. Washington Acad. Sci. 1900, 2, 41

## PERFEMIC, DOSILICIC, PERPOLIC, PYROLIC, PERMIRLIC, PERMIRIC, MAGNESIFEROUS, HOMESTEADOSE

104. Homestead.....	36.98	1.18	22.39	18.21	1.39	0.82	0.57	10.27	2.05	.....	Fe S 5.25	.....	Cr <sub>2</sub> O <sub>3</sub> 0.40 Mn O 0.25	99.85	3.75	or 3.3 ns 0.9 cm 0.7 ab 3.1 di 5.7 tr 5.3 hy 24.8 nf 12.3 ol 42.1	Cgb	Gumber and Schwager.....	Sitzber. München Akad. 1875, 5, 313-330. Mass anal. calc. by Wadsworth
105. Homestead.....	36.92	0.64	22.64	20.02	.....	1.42	.....	11.17	1.30	0.07	Fe S 5.82	.....	Li <sub>2</sub> O tr	100.00	3.57	ab 3.1 ns 2.1 tr 5.8 hy 34.9 nf 12.5 ol 41.5	Cgb	J. L. Smith.....	Am. Jour. Sci. 1875, 3, 10, 362. Mass anal. calc. by Farrington

## PERFEMIC, DOSILICIC, PERPOLIC, DOPOLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, FARMINGTONOSE

106. Lumpkin.....	40.73	2.28	14.70	28.10	0.04	1.05	.....	6.11	0.84	0.05	Fe S 6.10	.....	.....	100.00	3.65	ab 8.9 hy 26.2 tr 6.1 an 0.3 ol 51.1 nf 7.0 C 0.5	Cck	J. L. Smith.....	Am. Jour. Sci. 1870, 2, 50, 339. Mass anal. calc. by Farrington
107. Farmington.....	39.95	1.79	15.77	26.16	1.75	0.73	0.11	6.68	0.94	0.06	Fe S 5.00	.....	Cr <sub>2</sub> O <sub>3</sub> 0.58 Ni O 0.32 Cr O tr Mn O 0.16	100.00	...	or 0.6 di 5.6 cm 0.9 ab 5.8 hy 23.1 tr 5.0 an 1.7 ol 49.7 nf 7.7	Cs	L. G. Eakins....	Am. Jour. Sci. 1892, 3, 43, 66. Mass anal. calc. by Farrington
108. Utrecht.....	39.30	2.25	15.30	24.37	1.48	1.39	0.15	11.07	1.24	.....	1.90	0.01	Cr <sub>2</sub> O <sub>3</sub> 0.66 Mn O + Ni O 0.61 Cu O + Sn O <sub>2</sub> 0.25 Cu + Sn 0.02	100.00	3.61	or 1.1 ns 0.2 cm 0.9 ab 11.0 di 6.0 tr 5.2 hy 19.1 nf 12.3 ol 42.8	Cca	E. H. Baumhauer	Ann. Phys. Chem. 1845, 66, 465-498
109. Aussun.....	38.79	2.27	18.15	25.29	.....	1.14	0.18	7.11	1.02	0.06	2.11	.....	Cr <sub>2</sub> O <sub>3</sub> 0.77 Mn O 0.30 Cu + Sn 0.24 Mn 0.04 Fe S 2.53	100.00	3.50	or 1.1 hy 25.2 cm 1.1 ab 9.4 ol 45.0 tr 8.3 C 0.3 nf 8.5	Cc	E. P. Harris.....	Chem. Const. Meteor- ites 1850, 44-51. Mass anal. calc. by Farrington
110. Mauerkirchen...	38.14	2.51	25.70	21.73	2.27	1.00	0.48	6.30	.....	2.09	0.14	.....	Cr <sub>2</sub> O <sub>3</sub> 0.39	100.75	3.46	or 2.8 di 8.2 tr 5.5 ab 8.4 hy 8.5 sc 1.0 an 1.1 ol 57.1 nf 6.3 m 0.7	Cw	A. Schwager.....	Sitzber. München Akad. 1878, 8, 16-24
111. Alfianello.....	37.63	1.78	24.42	23.43	0.89	1.09	0.24	5.76	1.14	0.08	2.54	0.15	Cr <sub>2</sub> O <sub>3</sub> 0.10 Mn O 0.13 Cr O <sub>3</sub> 0.62	100.00	...	or 1.1 ns 0.2 cm 1.1 ab 8.3 di 3.6 sc 1.0 hy 17.3 tr 7.0 ol 51.9 nf 7.0	Ci	P. Maissen.....	Gazetta Chimica 1884, 13, 369
112. Blansko.....	37.08	2.39	14.95	23.90	1.25	0.74	0.19	16.09	0.87	0.06	0.06	.....	Chromite 0.62 Ni O 0.21 Mn O 0.40 Cu + Sn 0.08	98.98	3.40	or 1.1 di 2.7 tr 0.2 ab 6.3 hy 18.4 nf 17.1 an 2.8 ol 50.5	Cga	J. J. Berzelius...	Ann. Phys. Chem. 1834, 33, 8-25. Mass anal. calc. by von Reichen- bach 1865, 124, 213





## ANALYSES OF STONE METEORITES—Continued

## PERFEMIC, DOSILICIC, PERPOLIC, DOMOLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, FARMINGTONOSE—Continued

Name	Si O <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe O	Mg O	Ca O	Na <sub>2</sub> O	K <sub>2</sub> O	Fe	Ni	Co	S	P	Miscellaneous	Sum	Sp. gr.	Norm	Brezina's Symbol	Analyst	Reference
113. Hessle.....	36.91	1.55	13.43	25.06	2.08	1.57	....	16.36	2.16	tr	0.18	tr	Cu + Sn 0.02 C 0.68	100.00	3.92	ab 7.0 ns 1.2 tr 0.5 di 8.5 nf 18.5 hy 11.8 ol 50.9	Cc	A. E. Nordenskjöld.....	Ann. Phys. Chem 1870, 141, 205-224
114. Buschhof.....	36.01	2.48	20.98	27.17	0.71	0.26	0.33	7.92	1.51	tr	2.18	0.01	C + Sn O <sub>2</sub> + loss 0.15	100.00	3.52	or 1.7 hy 17.5 cm 0.2 ab 2.1 ol 57.7 tr 6.0 an 3.6 nf 9.4	Cwa	Grewingk and Schmidt.....	Archiv. Nat. Liv. u. Ehst. Kurlands 1864, 3, 421-554
115. Forest City.....	35.62	2.08	10.27	23.93	1.40	0.81	0.06	18.08	1.19	0.13	6.19	tr	Cr <sub>2</sub> O <sub>3</sub> 0.10 P <sub>2</sub> O <sub>5</sub> tr Ni O 0.14 Mn O tr	100.00	3.64	or 0.6 di 4.0 cm 0.2 ab 6.8 hy 20.8 tr 6.2 an 2.0 ol 40.2 nf 10.4	Ccb	L. G. Eakins.....	Am. Jour. Sci. 1890, 3, 40, 320. Mass anal. calc. by Farrington
116. Cape Girardeau..	35.57	2.27	11.04	23.75	1.38	0.86	0.11	16.46	1.32	0.11	5.68	....	Chromite 0.68 H <sub>2</sub> O 0.47 P <sub>2</sub> O <sub>5</sub> 0.20 Cu 0.01	100.00	3.67	or 0.6 di 2.7 cm 0.7 ab 7.3 hy 21.4 ap 0.7 an 2.0 ol 41.4 tr 5.7 nf 17.0	Cc	S. L. Penfield.....	Am. Jour. Sci. 1886, 3, 32, 230. Mass anal. calc. by Farrington
117. Heredia.....	33.10	1.25	16.97	20.39	1.19	0.83	0.04	24.59	1.51	....	....	....	....	99.87	....	ab 6.8 di 4.8 nf 26.1 hy 15.3 ol 40.9	Ccb	I. Domeyko.....	Ann. de la Universidad de Chile 1859, 16, 335-339. Mass anal. calc. by Wadsworth
118. Cabezzo de Mayo	29.29	0.51	5.24	28.00	0.09	0.35	tr	13.66	1.37	....	20.57	....	Chromite 0.92	100.00	....	ab 2.6 di 0.4 cm 0.9 hy 8.0 tr 20.6 ol 50.4 nf 15.0	Cw	S. Meunier.....	Thèse Faculté des Sciences de Paris, 1869, 9. Mass anal. calc. by Farrington
PERFEMIC, DOSILICIC, PERPOLIC, PEROLIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, ORNANSOSE																			
119. Shytal.....	32.05	2.54	23.88	22.90	1.12	1.50	0.67	10.38	1.63	....	0.78	0.05	Ni O 0.86 Cu 0.11	98.47	3.55	lc 3.1 ns 0.7 tr 2.1 ne 5.1 di 1.8 sc 0.4 ol 71.4 nf 12.1 am 1.2	Cib	T. Hein.....	Sitzber. Wien Akad. 1866, 54, 2, 558-561
120. Ornans.....	31.23	4.32	24.71	24.40	2.27	0.55	....	4.12	1.85	....	2.69	....	Chromite 0.40 Ni O 2.88 Mn O tr	99.42	3.60	ab 2.6 ol 69.4 cm 0.4 an 9.2 am 0.8 tr 7.4 mo 2.3 nf 6.0	Cco	F. Pisani.....	Comptes Rendus, 1868, 67, 663-665
121. Cold Bokkeveld..	30.80	2.05	29.94	22.20	1.70	1.23	....	2.50	....	tr	3.38	....	Cr <sub>2</sub> O <sub>3</sub> 0.76 Cu O 0.03 Ni O 1.30 C 1.67 Mn O 0.97 Bit. 0.25	98.78	2.69	ne 5.7 di 1.1 cm 1.1 an 0.3 ol 72.5 tr 9.2 am 1.1 nf 2.5	K	E. P. Harris.....	Sitzber. Wien Akad. 1859, 35, 512
122. Mount Vernon...	22.95	0.27	13.20	26.68	....	....	....	27.66	4.71	0.32	0.69	1.95	Fe <sub>2</sub> O <sub>3</sub> 0.11 Cu 0.03 Chromite 1.00 Graphite 0.09 Ni O 0.13 Al 0.12 Mn O 0.09	100.00	....	C 0.3 ol 58.0 mt 0.2 mo 4.1 cm 1.0 tr 0.7 sc 2.0 nf 32.8	P	Wirt Tassin.....	Proc. U. S. Nat. Mus. 1905, 28, 213-217. Mass anal. calc. by Farrington
PERFEMIC, DOMETALLIC, PERPOLIC, PERPYRIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, STEINBACHOSE																			
123. Steinbach.....	27.47	0.68	3.49	8.48	0.70	0.48	....	45.71	4.95	0.12	7.22	0.07	Chromite 0.32 Mn O 0.16 Schreibersite 0.15	100.00	....	Q 8.7 ns 1.2 cm 0.3 ab 3.7 di 2.0 sc 0.8 hy 25.8 tr 7.22 nf 50.8	S	Winkler.....	Nova Acta. der K. Leop. Carol. deutsch Akad. 1878, 40. Mass anal. calc. by Farrington
PERFEMIC, DOMETALLIC, PERPOLIC, DOPYRIC, PERMIRLIC, PERMIRIC, DOMAGNESIC, MINCIOSE																			
124. Mincy.....	20.64	3.55	8.88	8.08	2.71	....	....	49.18	5.73	0.16	0.99	0.08	....	100.00	4.84	an 9.7 di 3.0 tr 1.0 hy 21.5 sc 0.6 ol 9.0 nf 55.1	M	J. E. Whitfield...	Am. Jour. Sci. 1887, 3, 34, 468-469. Mass anal. calc. by Farrington
PERFEMIC, DOMETALLIC, PERPOLIC, PEROLIC, PERMIRLIC, PERMIRIC, PERMAGNESIC, MARJALAHTOSE																			
125. Marjalahti.....	8.07	....	2.38	9.47	....	0.04	0.01	73.95	5.71	0.34	....	....	Cr <sub>2</sub> O <sub>3</sub> 0.03	100.00	....	ol 20.0 nf 80.0	P	L. H. Borgström	Die Met. von Hvittis u. Marjalahti, Helsingfors 1903, 57. Mass anal. calc. by Farrington





# ADDITIONAL ANALYSES OF IRON METEORITES

The following analyses of iron meteorites have been made since the writer's compilation (Pubs. Field Museum Geol. Ser. 1907, 3, 59-110) or were overlooked in making that compilation.

## COARSE OCTAHEDRITES

Name	Fe	Ni	Co	Cu	Cr	P	S	C	Si	Cl	Insol	Miscellaneous	Total	Sp. gr.	Analyst	Reference
Bohumilitz.....	90.77	7.72	1.22	....	....	....	....	....	....	....	....	....	99.71	...	O. Koestler.....	1891, A. N. H. Wien, 6, 144
Cosby..... <sup>2</sup> / <sub>3</sub>	89.72	10.12	0.42	....	....	0.11	tr	....	....	....	....	....	100.37	...	R. v. Reichenbach.....	1861, Pogg. Ann. 94, 250
Nuleri.....	93.57	5.79	0.41	tr	....	0.13	tr	0.01	....	tr	....	Sa 0.04 Fe O + SiO <sub>2</sub> 1.32 Graphite 0.19	100.00	7.79	E. S. Simpson.....	1907, Bull. Geol. Survey, W. Australia, 26, 24-26
Wichita.....	90.77	8.34	0.26	0.02	....	0.14	0.02	....	....	....	....	....	99.88	...	J. W. Mallett.....	1884, A. J. S. 3, 28, 287
Wichita.....	91.39	7.91	0.40	tr	....	....	....	....	....	....	....	....	99.70	...	Cohen and Weinschenk...	1891, A. N. H. Wien, 6, 153
Wichita.....	92.37	6.74	0.59	0.03	....	0.03	....	....	....	....	....	....	99.76	...	Manteuffel.....	1892, A. N. H. Wien, 7, 155

## MEDIUM OCTAHEDRITES

Ivanpah.....	91.12	6.92	1.73	....	....	....	....	....	....	....	....	....	99.77	...	O. Koestler.....	1891, A. N. H. Wien, 6, 145
Ivanpah.....	92.68	7.43	0.66	0.01	....	0.03	....	....	....	....	....	....	100.81	...	Manteuffel.....	1892, A. N. H. Wien, 6, 149
Inca.....	90.73	8.20	0.22	....	0.35	0.23	tr	0.24	....	....	....	....	99.97	7.64	Halbach.....	1907, Neues Jahrb. Festband. 230
Ilimäe.....	91.53	7.14	0.41	tr	....	0.44	....	....	....	....	....	....	99.52	...	C. Ludwig.....	1871, Sitzb. Wien Akad. 194
Joe Wright.....	91.67	7.53	0.99	....	....	tr	....	....	....	....	....	....	100.19	...	Cohen and Weinschenk...	1891, A. N. H. Wien, 6, 158
Rancho de la Pila.....	91.78	8.35	0.01	....	....	tr	....	tr	....	....	....	....	100.14	...	Janke.....	1884, Beitr. Abh. natur. Ver. Bremen, 8, 517
Tanokami.....	90.11	8.56	0.62	....	....	0.43	....	....	....	....	....	....	99.95	7.60	Kodera.....	1906, Beitr. z. Min. Japan, 2, 30-52
Williamstown.....	91.54	7.26	0.52	0.03	0.05	0.12	0.17	tr	tr	....	....	....	99.69	8.10	W. Tassin.....	1908, A. J. S. 4, 25, 49-50

## FINE OCTAHEDRITES

Muonionalusta.....	91.10	8.02	0.69	0.01	0.01	0.05	....	....	....	....	....	....	99.88	7.89	R. Mauzelius.....	1909, Bull. Geol. Inst. Univ. Upsala, 9, 236
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## BRECCIATED OCTAHEDRITES

Ainsworth.....	92.22	6.49	0.42	0.01	0.01	0.28	0.07	0.09	0.05	....	....	....	99.64	7.85	W. Tassin.....	1908, A. J. S. 4, 25, 107
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## ATAXITES

Guffey.....	88.69	10.55	....	....	0.02	0.02	0.02	0.02	....	....	....	....	99.87	7.94	Booth, Garrett and Blair..	1909, Am. Mus. Jour. 9, 243
Weaver.....	81.81	16.63	1.18	....	....	tr	tr	....	....	....	....	Mn tr	99.62	7.99	F. Hawley.....	1910, Mineralogy of Arizona, 22
Weaver.....	79.60	18.80	1.60	....	....	tr	tr	....	....	....	....	Mn tr	100.00	7.98	W. B. Alexander.....	Same

